Reverendo in Christo Patri Michaeli Fessard,
Praeposito Provinciae Franciae Societatis Jesu,
signum qualecunque animi erga Societatem amantissimi
Volumina ista mittebat,
Reverendus Eduardus J. O'Brien,
Pastor Ecclesiae Stae Mariae, New Haven,
Connecticut.

G602/15

33d Congress, 2d *Session*. SENATE. Ex. Doc. No. 78.

REPORTS

OF

EXPLORATIONS AND SURVEYS,

TO

ASCERTAIN THE MOST PRACTICABLE AND ECONOMICAL ROUTE FOR A RAILROAD

FROM THE

MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

MADE UNDER THE DIRECTION OF THE SECRETARY OF WAR, IN

1853-4,

ACCORDING TO ACTS OF CONGRESS OF MARCH 3, 1853, MAY 31, 1854, AND AUGUST 5, 1854.

ECOLE SAINTE GENEVIEVE
B. D. J.

VOLUME I.

WASHINGTON:
BEVERLEY TUCKER, PRINTER.
1855.

C. P.

DOM. S. ALOYS. + JERSEIENS. + S.J. +
IHS

CONTENTS OF VOLUME I.

REPORT OF THE SECRETARY OF WAR.
EXAMINATION OF THE REPORTS OF THE SEVERAL ROUTES EXPLORED.
RAILWAY MEMORANDA.
LETTER OF MAJOR GENERAL THOMAS S. JESUP.
REPORT OF GOVERNOR I. I. STEVENS.

IN SENATE—February 24, 1855.

Resolved, That there be printed, for the use of the Senate, ten thousand copies of the several reports of surveys for a railroad to the Pacific, made under the direction of the Secretary of War; and also of the report of F. W. Lander, civil engineer, of a survey of a railroad route from Puget's Sound, by Fort Hall and the Great Salt lake, to the Mississippi river; and the report of John C. Frémont, of a route for a railroad from the head-waters of the Arkansas river into the State of California: together with the maps and plates accompanying said reports, necessary to illustrate the same; and that five hundred copies be printed for the use of the Secretary of War, and fifty copies for each of the commanding officers engaged in said service.

Attest: ASBURY DICKINS, *Secretary.*

THIRTY-SECOND CONGRESS, SECOND SESSION—Chapter 98.

Sect. 10. *And be it further enacted,* That the Secretary of War be, and he is hereby authorized, under the direction of the President of the United States, to employ such portion of the Corps of Topographical Engineers, and such other persons as he may deem necessary, to make such explorations and surveys as he may deem advisable, to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean, and that the sum of one hundred and fifty thousand dollars, or so much thereof as may be necessary, be, and the same is hereby, appropriated out of any money in the treasury not otherwise appropriated, to defray the expense of such explorations and surveys.

Approved March 3, 1853.

THIRTY-THIRD CONGRESS, FIRST SESSION—Chapter 60.

Appropriation: For deficiencies for the railroad surveys between the Mississippi river and the Pacific ocean, forty thousand dollars.

Approved May 31, 1854.

THIRTY-THIRD CONGRESS, FIRST SESSION—Chapter 267.

Appropriation: For continuing the explorations and surveys to ascertain the best route for a railway to the Pacific, and for completing the reports of surveys already made, the sum of one hundred and fifty thousand dollars.

Approved August 5, 1854.

Erratum.—On page 3, report of Secretary of War, for "March 31" read *March* 3.

Note.—In the note to Table A, page 31, report of the Secretary of War, marked thus *, which reads, "These are the estimates of the office, those of Governor Stevens having been brought to the same standard of increased cost as the other routes, and his equipment reduced to that of the other routes. His estimates were $117,121,000 and $7,030,000;" the sum of $117,121,000 is the estimate for the whole route from St. Paul to Seattle. From St. Paul to Vancouver the estimate of Governor Stevens is $110,091,000.

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REPORT

OF

THE SECRETARY OF WAR

ON THE

SEVERAL RAILROAD EXPLORATIONS.

1a

REPORT OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, February 27, 1855.

SIR: I have the honor, in obedience to the provisions of the 11th section of the army appropriation act, approved March 31, 1853, to lay before Congress printed reports of the engineers employed under the provisions of that act to make such explorations and surveys as this department might deem advisable, in order to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean.

The great amount of labor required in the preparation of the general map, originally designed to accompany this report, and the unfinished condition of the original maps and other data, have delayed its completion beyond the period anticipated, but it is confidently believed that its engraving will be finished in time to accompany the extra copies of the report ordered by the two houses of Congress. It embraces the territory of the United States between the great lakes and the Mississippi river, on the east, and the Pacific ocean on the west. It is based upon the most reliable astronomical data within those limits; and the details having been compiled with care, from all the government explorations and surveys and other reliable authorities, it will present more minute information upon the region embraced by it than has heretofore been exhibited on any general map. It will show the relation to each other of the different railroad routes recently explored, their connexions with prominent points on Lakes Superior and Michigan, the Mississippi river and the Gulf of Mexico, and with the ports of the Pacific; and, exhibiting only such features as have been determined by reliable observers, it will be of great value in showing what further explorations are necessary, and in determining their direction and extent.

I have heretofore reported the nature of the explorations and surveys ordered in compliance with this act; and by a reference to the statements there made, it will be seen that in order to accomplish as much as possible within the limited period indicated, not only were there as many distinct corps employed as there were routes to be surveyed, but several parties were, in some cases, employed upon different sections of the same route. It appears, therefore, necessary, in submitting these several reports, many of which are quite voluminous and in detached parts, to present a general recapitulation of their results, indicating those distinguishing characteristics, the comparison of which will determine which of the routes surveyed best fulfils the condition of practicability and economy proposed by the act.

I will here repeat the general sketch of the country given in my first annual report, but corrected in accordance with the results of the recent explorations. This will serve, in the absence of a more elaborate description, to give some general idea of the nature of the country over which they extended.

The western portion of the continent of North America, irrespective of the mountains, is traversed from north to south by a broad, elevated swell or plateau of land, which occupies the greater portion of the whole space between the Mississippi river and the Pacific ocean. The crest of this plateau, or the water-shed of the country, is nearly midway between the Pacific coast and the Mississippi. It may be represented on the map by an undulating line traced between the headwaters of the streams which flow eastward and those which flow westward. It divides the whole area between the Mississippi and the Pacific into two nearly equal portions—that on the east being somewhat the larger. This crest of the water-shed has its greatest elevation in Mexico; and thence declines to its lowest point about the latitude of 32°, where it has a height of about 5,200 feet, between the waters of the Rio Grande and those of the San Pedro, a tributary of the Gila. From this parallel it increases in altitude northward, and reaches its maximum near the 38th parallel, where it is about 10,000 feet high. Thence it declines as we pass northward: and, in latitude 42° 24′, it has an elevation of, say, 7,490 feet; and in the latitude of about 47° it is reported to be at least 1,450 feet lower. The heights here given are those of the lowest passes over the crest or water-shed of the great plateau of the country, and not those of the mountain peaks and ridges which have their base upon it, and rise, in some cases, to the height of 17,000 feet into the region of perpetual snow.

The slope of the plateau on the east and south, towards the Mississippi and the Gulf of Mexico, is comparatively gentle, and in the northern part of Texas, that known by the name of the Llano Estacado, or Staked Plain, is by steps. It is traversed by the Missouri, the Platte, the Arkansas, and other large rivers, which rise among the mountains near the crest, and flow eastward and southward in channels sunk beneath the general surface-level of the plains.

Its crest, and nearly the entire distance thence to the Pacific, is occupied by high plains or basins, differing from each other in elevation from 1,000 to 3,000 feet, and by mountain peaks and ridges, varying in direction to almost every point of the compass, though they have a general course north and south. Many of these mountains, including those that bound this system, have obtained the name of chains, and a short classification of them will now be attempted, although it is to be premised that our knowledge of them is most imperfect, and the classification now made, future explorations will probably show to be erroneous. The only proper classification must be made by the geologist, after a thorough exploration for this purpose, which it will require a long period to accomplish.

These mountains may be considered as constituting three great systems, extending generally throughout our possessions in a north and south direction; and though this arrangement may not be the best or most accurate, yet it will enable us to take a comprehensive view of the whole as regards the construction of a railroad, since any direct line that can be traced from the Mississippi to the Pacific, except near the 48th and 32d parallels, will encounter each of these three systems in some point.

Calling the most eastern system No. 1, we find a portion of it, crossing the Rio Grande, and entering Texas at the Great Cañon. Its extension south into Mexico forms the east front of the Sierra Madre. Running northward, this system includes all the mountains on either side of the Rio Grande, enclosing its valley and the Salinas Basin. Those on the east form the divide between the Pecos and Salinas Basin, and between the Rio Grande and Canadian; on the west they divide the waters of the Rio Grande from those that flow to the Gulf of California. Those on the east are sometimes called the Rocky mountains, sometimes the Sierra Madre; and this last name is sometimes applied to those on the west. There seems to be a necessity for considering the mountains on both sides of the Rio Grande as one system. These may be said to unite near the headwaters of the Rio Grande and Arkansas, and here the mountains have their greatest development. The Sierra de la Plata extends to the southwest, the Elk mountains to the west, and the various chains forming the Park mountains to the north. The Park mountains, in latitude 41° 30′, sink into the plateau, forming the region of the South Pass; and the only continuation we have of this system is in the Black Hills, which continue to the north, with diminished elevation, till, in latitude 46° 15′, they are merged into the coteau through which the Upper Missouri makes its passage.

Among the mountains included in this system are the Sierra Madre, a portion of what is called the Rocky mountains, the Diabolo mountains, the Guadalupe mountains, Hueco mountains, Organ mountains, Sandia mountains, Santa Fe mountains, Sierra Blanca, Sierra Mojada, Sierra San Juan, Sierra de la Plata, Elk mountains, Park mountains, Medicine Bow mountains, and Black Hills.

System No. 1 is thus but partially gorged by the Rio Grande, whose passage of the Great Cañon is wholly impracticable for any method of communication; that of El Paso is practicable. It is completely cut through by the North Platte and Sweet Water, forming a practicable route; and is turned by the Upper Missouri.

Low mountains or hills are known to exist between the Black Hills and the Wind River chain, about the headwaters of the Yellowstone and Missouri; but this region is too little known to be treated of with confidence, and may have a decided effect in modifying this classification.

System No. 2. If, from the Great Northern Bend of the Missouri, we travel west for 450 miles, we come again upon what are called the Rocky mountains; and still further west lies the Cœur d'Alene, or Bitter Root range, the two enclosing the Bitter Root or St. Mary's valley; and both are considered as forming a part of this system. Following it to the south, it includes the Wind River chain, the Bear mountains, the Uinta mountains, and the Wahsatch, which last continue as far south as it has been explored, probably forming the divide between the Great Basin and the Colorado, till the junction of the latter with the Gila.

System No. 3. From the junction of the Gila and Colorado, we find continuous mountains running to the northwest, and terminating at Point Conception, on the Pacific. On the south they are joined by the mountains forming the peninsula of California, the junction being at the San Gorgonio Pass, in latitude 33° 45′.

On the north, two chains leave this range in latitude 35°. One, called the Coast range and Coast mountains, lies to the west of the San Joaquin and Sacramento valleys, the waters of which break through them at the Bay of San Francisco. The other, called the Sierra Nevada, lies to the east of these valleys. A great depression, forming a plateau, is known to exist in the Sierra Nevada in latitude 40° 30′, and another in latitude 42° 45′, near Lake Abert. This chain may, perhaps, be considered as terminating at or in these plateaus, or to find its continuation in the Cascade or Coast range, which extend into the British possessions, being broken through by the Columbia and partly by the Klamath rivers.

The Blue mountains, to the south of the Columbia, represented as having a general northeast direction, may be considered, along with the mountains mentioned since leaving the Colorado, as forming system No. 3.

The Humboldt River chain, running north and south, (where crossed,) and separating the waters of the Humboldt or Mary's river from those of the Great Salt Lake Basin, is a marked feature; but as to its connexion, north and south, with other ranges, nothing is certain.

There seem good reasons for believing that the east and west ranges, represented as separating the Columbia River basin from the Great Basin, as well as the range represented as extending west from the Vegas of Santa Clara, are only apparently such, the deception arising from the overlapping of the side spurs to chains, the general direction of which is north and south.

The "triangular space" lying between the Rio Grande, Gila, and Colorado, is everywhere, so far as known, exceedingly mountainous; the ranges, such as the Mogollon and San Francisco mountains, having a general northwest direction. Too broad an interval exists between the explorations of Lieutenant Whipple and those of Captain Gunnison, to enable us to speak with certainty of their relation to the systems already alluded to.

In portions of the mountain region, the waters find no outlet to the sea, but drain into lakes and ponds, or sinks, carrying with them all the impurities of the basins to which they belong, and are there uniformly brackish or very salt. Prominent examples of this are the Salinas Basin, of New Mexico, and the Great Salt Lake Basin in Utah.

From most portions of this interior mountain belt, the waters have been able to force their barriers and escape to the ocean. The valleys thus drained are, those of the southern tributaries of the Upper Missouri, that of the North Fork of the Platte, and its tributary the Sweet Water, between the first and second systems; that of the Upper Rio Grande del Norte, in the first system; that of the Great Colorado of the West and its tributaries, between the first and second systems; those of the waters of the Bay of San Francisco and of the Klamath river, in the third system; and that of the Columbia river and its tributaries, between the second and third systems. Some of these streams, as well as others in the enclosed basins, have in places worn for themselves, through the solid rock, the most stupendous chasms or cañons, often 2,000 feet in vertical height, many of which it is impossible to follow or to cross.

The position of this belt of mountain region, stretching from north to south, gives rise to a peculiarity of climate and soil. Fertility depends principally upon the degree of temperature and amount of moisture, both of which are much affected by increase of elevation; and the latter also depends on the direction of the wind. The upper or return current of the trade-wind, flowing backward towards the northeast, gives a prevalence of westerly winds in the north temperate zone, which tends to spread the moisture from the Pacific over the western portion of our continent. These winds, however, ascending the western slope of the mountain ridges, are deprived of their moisture by the diminished temperature of the increased elevation; and hence it is that the plains and valleys on the eastern side of the ridges are generally parched and barren, and that the mountain system, as a whole, presenting, as it were, a screen against the moisture with which the winds from the west come laden, has for its eastern margin a sterile belt, which probably extends along the whole range, with a width varying from 250 to 300 and 400 miles.

From the foregoing sketch it will be perceived that the lines of exploration must traverse three different divisions or regions of country lying parallel to each other, and extending north and south through the whole of the western possessions of the United States. The first is that of the country between the Mississippi and the eastern edge of the sterile belt, having a varying width of from 500 to 600 miles. The second is the sterile region, varying in width from 200 to 400 miles; and the third, the mountain region, having a breadth of from 500 to 900 miles.

Explorations show that the surface of the first division, with few exceptions, rises in gentle slopes from the Mississippi to its western boundary, at the rate of about six feet to the mile, and that it offers no material obstacle to the construction of a railroad. It is, therefore, west of this that the difficulties are to be overcome.

The concurring testimony of reliable observers had indicated that the second division, or that called the sterile region, was so inferior in vegetation and character of soil, and so deficient in moisture, that it had received, and probably deserved, the name of the desert. This opinion is confirmed by the results of the recent explorations, which prove that the soil of the greater part of this region is, from its constituent parts, necessarily sterile; and that of the remaining part, although well constituted for fertility, is, from the absence of rains at certain seasons, except where capable of irrigation, as uncultivable and unproductive as the other.

This general character of extreme sterility likewise belongs to the country embraced in the mountain region. From the western slopes of the Rocky mountains to the 112th meridian, or the western limit of the basin of the Colorado, the soil generally is of the same formation as that lying east of that mountain crest, mixed, in the latitudes of 35° and 32°, with igneous rocks; and the region being one of great aridity, especially in the summer, the areas of cultivable land are limited. The western slopes of the highest mountain chains and spurs within this region being of a constitution favorable to fertility, and receiving much larger depositions of rain than the plains, have frequently in their small valleys a luxuriant growth of grasses, which sometimes clothes the mountain-sides; and where the wash is deposited on mountain stream or river-bottom the soil is fertile, and can be cultivated, if the elevations are not too great, and the means of irrigation available. Such mountain-valleys and river-bottoms exist upon all the routes, and the difference in the areas found in the different latitudes is not sufficiently great to be of any considerable weight in determining the question of choice of route. It is probable that all the routes are nearly on an equality in this respect.

The cultivable valleys of the Rocky mountain district near the route of the 47th parallel do not probably exceed an area of 1,000 square miles, though there are extensive tracts of fine grazing lands. In this latitude the great sterile basaltic plain of the Columbia, and the barren table-lands, spurs, and mountain masses of the Cascade range, principally occupy the space between the Cœur d'Alene mountains and the main chain of the Cascade system. In this area, where the rocks are principally of igneous origin, there are likewise occasional valleys of cultivable soil. The western slopes of the Cascade mountains descend to the borders of Puget sound.

On the routes of the 41st and 38th parallels, in the region under consideration, the only large body of soil capable of productive cultivation, by the construction of suitable works for irrigation, is that of the basin of the Great Salt lake, estimated to be 1,108 square miles in extent, about one-tenth part of which, being susceptible of cultivation without the construction of irrigating canals, is now cultivated by the Mormons. Here also are extensive grazing lands.

The great elevated plain of the Rocky mountains in latitudes 41° and 42°, and that of latitude 38°, called the San Luis valley, are covered with wild sage, the narrow border of grass found upon the streams being the chief, almost only, production capable of supporting animal life. The slopes of the mountains bounding them are covered with grass.

The plains of the Great Basin, whose greatest width (500 miles) is in latitude 41°, are, with the exception heretofore stated, entirely sterile, and either bare or imperfectly covered with a scattered growth of wild sage. Where a stream or lake is found in this desolate region, its immediate borders generally support a narrow belt of grass and willows; the former being also found on the mountain slopes, where occasionally a scattered growth of stunted cedars is likewise seen. Water is found on the mountain-side. The predominating rocks, from the Wahsatch mountains to the Sierra Nevada, are of igneous origin. In the southern portion of the Basin the granitic rocks are more abundant than the volcanic.

On the routes of the parallels of 35° and 32° the valleys of the Pecos, Rio Grande, Gila, and Colorado of the West, contain the largest areas of fertile soil capable of irrigation and cultivation. That in New Mexico is estimated at 700 square miles, exclusive of the regions occupied by Indians, of which 200 square miles are now under cultivation. Here the grazing land is of very great extent, the table-lands, as well as the mountain-sides, being covered with grass. The valley of the Colorado of the West, between its mouth and the 35th parallel, contains 1,600 square miles of fertile soil, which can be irrigated from the river.

The plains south of the Gila in its lower course, and that west of the Colorado, extending to the Coast range, called the Colorado desert, as well as the contiguous portion of the Great Basin, are bare and exceedingly sterile in their aspect, and closely resemble each other. The soil of the Colorado desert, and much of this as well as other parts of the Great Basin, is, however, favorably constituted for fertility, but the absence of the essential, quickening element, water, leaves them utterly unproductive.

West of the Coast, Sierra Nevada, and Cascade mountains the country is better watered than that just considered; and the soil being mostly well constituted for fertility, is productive in proportion to the yearly amount of precipitation and the means of irrigation.

The general position and direction of the four routes to be explored were explained in my report of December 1, 1853, and copies of the instructions given to the parties were appended to it.

They were directed to observe and note all the objects and phenomena which have an immediate or remote bearing upon the railway, or which might seem to develop the resources, peculiarities, and climate of the country; to determine geographical positions, obtain the topography, observe the meteorology, including the data for barometric profiles, and two of the parties were to determine the direction and intensity of the magnetic force. They were to make a geological survey of the lines; to collect information upon, and specimens of, the botany and zoology of the country; and to obtain statistics of the Indian tribes which are found in the regions traversed. Thus would be obtained all the information for the general consideration of the question, as well as the data upon which the cost of construction and working a railroad depend.

If the results of the explorations made under these instructions do not furnish the data requisite to solve every question satisfactorily, they at least give a large amount of valuable information, and place the question in a tolerably clear light. We see now, with some precision, the nature and extent of the difficulties to be encountered, and, at the same time, the means of surmounting them.

As the readiest mode of communicating the nature and extent of the information contained in the reports herewith submitted, a brief description of each route, its characteristic features, facilities, difficulties, and probable cost of construction, will be given.

For a long distance west of the Mississippi, the enterprise of private companies, acting under State charters, has explored the country, and has projected or is constructing railroads, stretching towards the Pacific. As the examinations made under these auspices, and our general knowledge of that part of the country, afford the information necessary to determine all questions bearing upon the practicability of a railroad, it has been deemed unnecessary to incur the expense and delay of continuing the explorations directed by the act, eastward of the points reached, to which railroads are already projected, and consequently but one of the routes, the most northern, has its starting-point on the Mississippi. The connexion of the others with that river, as well as with the seaports of Atlantic and Gulf States, is shown by a table (B) hereto annexed, compiled from the best railroad maps.

ROUTE NEAR THE FORTY-SEVENTH AND FORTY-NINTH PARALLELS OF NORTH LATITUDE.

Taking the routes in their geographical order, that near the 47th parallel, the general direction of the exploration of which was intrusted to Governor Stevens, of Washington Territory, will be the first discussed.

The route was to cross the Rocky mountains at the sources of the tributaries of the Missouri and Columbia rivers, and, in approaching and leaving the mountains, to follow as far as practicable the valleys of these rivers and their tributaries.

The general direction of the Missouri from the Rocky mountains to the Great Bend, in latitude 48° 30′, is from west to east, and thence to latitude 43° 30′ southeast. The point where the direction changes is reached from St. Paul, on the Mississippi, by a line passing up on the east side of that river to Little Falls, 109 miles, and there crossing it; thence gaining the divide between the waters of Hudson's bay and those of the Missouri, keeping on this divide, and approaching, in longitude 103°, within a few miles of the 49th parallel; then passing southerly, between the 104th and 105th meridians, and entering the valley of the Missouri river. The route then follows this valley to the mouth of Milk river. The ground near the Missouri here becoming rough and broken, the route is obliged to leave it and follow the valley of Milk river 187 miles; then entering the prairies, which near the mountains are more favorable for location than near the Missouri river, it continues in a line nearly parallel to the river, across its tributaries, the Marias, Teton, and Sun rivers, and enters either Clark's or Cadotte's Pass.

As far as the crossing of Sun river, 1,093 miles from St. Paul, the route is over river bottom or prairie, the usual expense of construction over such ground being increased by the necessity of guarding against freshets by embankment on the river bottoms, of ballasting in the soft, sticky soil of Milk river, of providing supplies of water during the dry season, over certain portions of the route, by reservoirs and aqueducts, estimated to cost, with planting trees for supply of fuel, $3,000,000, and of transporting ties and lumber for distances of from 100 to

470 miles—forest-growth suitable for ties and lumber not being found at closer intervals on the route. These, in connexion with the uninhabited and uncultivable condition of the country for 740 miles, form the difficulties of this portion of the route, and will materially increase the cost of its construction.

The most difficult portion of the whole route is, however, that which is now entered upon, viz: from Sun river to the Spokane, a distance of 365 miles, embracing the Rocky mountains proper, and a secondary chain lying west of them, called Cœur d'Alene and the Bitter Root mountains.

Through the Rocky mountains seven passes were explored; but the only ones among them, upon which the information obtained was sufficiently thorough and complete to enable projects to be made, are two (Clark's and Cadotte's) lying near each other in latitude 47°, and connecting the headwaters of Dearborn river, a tributary of the Missouri, with the Blackfoot, a head branch of the Columbia.

The summit ridge of Clark's Pass has an elevation of 6,323 feet, and requires a tunnel 2½ miles long, at an elevation of 5,300 feet. Its connexion with the main line of survey along the valley of the Blackfoot river was not made, though "believed" practicable, with grades of 50 feet per mile. The interval unexamined is 4½ miles long. This pass has been adopted by Governor Stevens in the railroad estimate, and is probably practicable.

The approach to the other pass (Cadotte's) is difficult, owing to the numerous deep ravines of the tributaries of a branch of Dearborn river, which the road must cross. The summit of the pass has an elevation of 6,044 feet; requires a tunnel 4¼ miles long, at an elevation of 5,000 feet, with grades of approach of 60 feet, and of departure of 40 feet, per mile.

A tunnel 4¼ or even 2½ miles in length, in rock or part rock, at a depth below the summit of 1,000 feet, in a severely-cold climate, 800 or 1,000 miles distant from a thickly-inhabited district, is a work of vast difficulty; and the necessity of the construction of one of these two tunnels, in connexion with the character of the approach, and the difficult nature of the work required, continuing westward as far as the crossing of the Spokane river, in all a distance of 365 miles, is one of the most serious objections to the route.

From either pass the route seeks the Blackfoot river, with the view of reaching Clark's fork, which opens the only pass through the Bitter Root mountains, the practicability of which was determined. In order to reach Clark's fork, two routes were examined. The first follows the Blackfoot river to its junction with Hell-Gate, a distance of 93 miles. The valley is narrow and wooded, the stream winding, and for twenty miles there is a narrow gorge. Numerous bridges will be required. The Hell-Gate, a few miles after being joined by the Blackfoot, empties into the St. Mary's, called below this junction the Bitter Root. The construction of the road along this stream to its junction with Clark's fork will be a work of great difficulty and expense, requiring short curves, steep gradients, numerous bridges, heavy side-cutting, and high embankments, in consequence of the spring freshets, (from twenty to thirty feet of vertical rise.) From the nature of the examination, its practicability cannot be considered as established.

The other route, (shorter, and probably less difficult,) having followed the Blackfoot but a short distance, crosses to the Jocko, descends this to the Flathead, and descends the latter to its junction with the Bitter Root, forming Clark's fork, bounded closely by high, rocky mountains. Having reached Clark's fork, the route continues along this river as far as Lake Pend d'Oreille, between rugged, rocky mountains, which at several points crowd upon the river. The valley of this river is heavily timbered, principally with pine, and, with the lake, it is subject to freshets fifteen feet in height. Leaving Lake Pend d'Oreille at its lower extremity, the route crosses to the Spokane without difficulty. At the Spokane river the continuous mountain region and the forest terminate, and "all great difficulties of location upon the route cease." The earth-excavation and embankment throughout this section (from the east base of the Rocky mountains to the Spokane river, 365 miles) will be large in amount, and expensive; there will be frequent rock-excavation, and the bulk of the rock-excavation in the entire route will be in this section. It is evident that the difficulties of construction will be great, and the cost excessive.

Upon the passes of the Rocky mountains, Governor Stevens says: "It is not doubted there are other passes in this portion of the Rocky mountain range, even better than those explored; they are indicated by the general depression of the mountain range, with the greater frequency of the streams stretching out to meet each other from the opposite slopes of the mountains; and I consider it important that, in future operations, a whole season should be devoted to their thorough examination, and that instrumental surveys should be made of the pass found to be the most practicable."

Leaving the Spokane, the route enters the Great Plain of the Columbia, a table-land stretching from the Cœur d'Alene to the Cascade mountains, a distance of 200 miles. Its central and western portions are of trap formation, and are described on the map as sandy, rocky, and sterile. Its summit, 800 feet above the Spokane river, is readily attained, the treeless plain is crossed in a distance of 110 miles, and a suitable point for crossing the Columbia river, 400 or 450 yards wide, reached, 140 miles distant from the Spokane. This point is about equally distant from the navigable waters of the Pacific in Puget sound and in the Columbia river. The whole intermediate space is occupied by the Cascade mountains, with their secondary chains, spurs, and high, broken table-lands, through which there are but two passes reported practicable for a railroad—that of the Columbia river and that of the Yakima, sometimes erroneously called the Snoqualme.

The Yakima Pass gives the most direct route to Puget sound, the distance by it being 150 or 160 miles shorter than by the Columbia River Pass. It requires a tunnel through rock, (siliceous conglomerate,) either 4,000 yards long, 3,000 feet above the sea, or a tunnel 11,840 yards long, 2,400 feet above the sea. The reconnaissance did not extend westward from the summit more than three miles. The evidence respecting the amount of snow found on the summit of the pass at the close of winter, makes it probable that it is then 20 feet deep there. This question should be satisfactorily settled, and the reconnaissance completed, before the practicability of the pass can be considered established. In the opinion of the officer making the reconnaissance—Captain McClellan, Corps of Engineers—the pass is barely practicable, and only at a great cost of time, labor, and money. Under every favorable condition of position the construction of either of the proposed tunnels would be seriously objectionable; but where the position itself is so unfavorable, the final advantages should be very great to determine the selection of this route. The information now possessed is sufficient to decide against this route.

The route by the pass of the Columbia follows that river from the Great Plain, being generally located, as far as the Dalles, in bottom-lands which present no difficulties. From the Dalles to near Vancouver, 90 miles, the rocky bluffs close upon the river, and the work required will be similar to that of the Hudson River railroad along the mountain region. In the opinion of Mr. Lander, "the high floods to which the Columbia river is subject, are serious obstacles to obtaining the best location for cheap construction offered by its valley." In 1854, the rise of the river during the flood was 10 feet above spring level, and 17 feet above summer level.

The Columbia river is navigable for sea-going vessels to Vancouver, the point now reached; but the unfavorable character of the entrance to that river, and the great superiority of the ports on Puget sound, seemed to render it expedient to adopt some one of the latter as the Pacific terminus of this route. Continuing down the Columbia, therefore, through bottom-lands, to the mouth of the Cowlitz, the route enters the wide and comparatively flat and wooded valley of that river, ascends it, and, crossing over the wooded and prairie plains, which, "though not fully explored, are sufficiently well known to insure the unusually favorable character of the country for the construction of a railway," reaches Seattle, the best port on the east side of Puget sound.

From the Rocky mountains to Seattle, wood, stone, and other building materials, are found along the line of the route, or at points so accessible to it, that it may be considered well supplied with them throughout.

The information upon the character of the soil upon the route does not admit of satisfactory conclusions to be deduced. It is sufficient, however, to show that in this latitude, as in that of the Arkansas, the uncultivable region begins about the 99th meridian. Immediately under the Rocky mountains the soil improves, probably from the mountain wash. The tertiary and cretaceous formations extend, in these latitudes, from about the 97th meridian to the eastern base of the Rocky mountains, and, under the meteorological conditions found in this space, are unsuitable for agricultural purposes. There are some very limited exceptions to this general character in portions of river bottoms. These tertiary formations in the arid regions of Asia and Africa form the great deserts of those countries.

The country west of the Rocky mountains to the Pacific slopes may likewise be described as one of general sterility. The eastern portion of the Great Plain of the Columbia is represented to be grassed; its middle and western parts almost entirely sandy, rocky, and sterile. The mountain masses, spurs, and table-lands of the Cascade chain, east of the main crest, are sterile. There are exceptions to this general sterility in the mountain valleys, where the soil is better constituted for fertility, and the rains more abundant; but, although portions of these are suitable for agricultural purposes, they are better adapted to grazing. The sum of the areas of cultivable soil in the Rocky mountain region does not exceed, if it equals, 1,000 square miles. West of the Cascade mountains there are rich river bottoms, clay formations that are arable, and prairies offering good grazing.

The principal favorable characteristics of this route are its low profile, low grades, and the low elevation of the mountain passes, and its connexion with the Missouri and Columbia rivers. The reported sum of the ascents and descents is the least of all the routes; this proportion may, however, be changed when the minor undulations are measured. The principal unfavorable features are, in construction, the tunnel required on the Rocky mountains, and the difficulty and expense of construction from the eastern approach of the Rocky mountains to the Spokane river, and the expense of the construction along the Columbia river, from the Dalles to near Vancouver. These, when considered carefully, are serious objections to the route, not only in the money, but the time, they will consume. In thickly-populated countries their construction would be difficult and costly; situated as they are—the Rocky mountain region especially—the difficulties, cost, and time required, are greatly increased.

The severely-cold character of the climate throughout the whole route, except the portion west of the Cascade mountains, is one of its unfavorable features; and, for national considerations, its proximity to the dominions of a powerful foreign sovereignty must be a serious objection to it as a military road.

Its cost has been estimated by Governor Stevens, by the Columbia River valley and the Cowlitz, at $117,121,000; the cost of work at eastern prices having had 25 per cent. added to it from the Bois des Sioux to the Rocky mountains, and 40 per cent. thence to the Pacific. It has been thought safer to add 100 per cent. to the cost at eastern prices from the eastern slope of the Rocky mountains to the Pacific. This would swell the estimate to $150,871,000.

Should Governor Stevens have included a full equipment in his estimate, $10,000,000 should be subtracted from this sum to bring the estimate in accordance with those of the other routes, and the cost then becomes $140,871,000.

The length of the route from St. Paul to Vancouver is 1,864 miles. The sum of ascents and descents, as far as reported, is 18,100 feet, which will be equivalent, in the cost of working the road, to an increased horizontal distance of 343 miles: this added to the length of the line of location, gives for equated length 2,207 miles.

From St. Paul to Seattle, by the Columbia route, is 2,025 miles, which the sum of ascents and descents increases to an equated distance of 2,387 miles.

The work upon this route, under Governor Stevens, embraced a wider field of exploration than that upon any other explored, and a great amount of topographical and general information was collected in relation to the country traversed. The necessary astronomical observations were not made to determine accurately the longitudes of the several stations, and the loss of his barometrical observations, after the completion of the field-work, left no means of revising and verifying the profile of the route.

The examination of the approaches and passes of the Cascade mountains, made by Captain McClellan, of the Corps of Engineers, presents a reconnaissance of great value, and though performed under adverse circumstances, exhibits all the information necessary to determine the practicability of this portion of the route, and reflects the highest credit on the capacity and resources of that officer.

ROUTE NEAR THE FORTY-FIRST AND FORTY-SECOND PARALLELS OF NORTH LATITUDE.

About one-half of the route in this latitude, extending from the Missouri river to Fort Bridger, on a tributary of Green river, has not been explored with a special reference to the practicability of constructing a railroad, and the reports do not contain all the details necessary to the elucidation of the subject. The information respecting it is to be found in the reports of Col. Fremont and Capt. Stansbury.

From Fort Bridger to Fort Reading, on the Sacramento river, the exploration has been made by Lieut. E. G. Beckwith, under the appropriation for that purpose.

The route may commence on the Missouri, either at Fort Leavenworth, about 245 miles from the Mississippi at St. Louis, or at Council Bluffs, about 267 miles from the Mississippi at Rock Island, ascend the Platte and enter the eastern chain of the Rocky mountains (the Black Hills) by the North fork and its tributary, the Sweet Water. Another route, by the South fork and a tributary called Lodge Pole creek, has been suggested by Capt. Stansbury as shorter and less expensive; but the information respecting it is not sufficiently full to make further mention of it necessary.

From the Missouri river to the entrance of the Black Hills, 30 miles above Fort Laramie, 520 miles from Council Bluffs, and 755 miles from Fort Leavenworth, the route resembles others from the Mississippi to the Rocky mountains, and needs no special mention. Its cost per mile will be about the same.

The route west of this point crosses many lateral streams that have cut deep ravines into the soil, and leaves the Platte just below the Hot Spring Gap, above which it is walled in by cañons. To avoid these, the route crosses a range of hills 800 feet above the river, and descending to the Sweet Water, a branch of the Platte, follows that stream to its source, where the summit of the plateau of the South Pass (elevation 7,490 feet) is attained. The valley of the Sweet Water is generally rather open, but occasionally it cuts through mountain spurs, forming cañons.

From the first gorge in the Black Hills to the summit of the pass, 291 miles, the work will be difficult and expensive, and is assimilated in amount to that of the Baltimore and Ohio railroad.

From the South Pass the route follows down Sandy creek, a tributary of Green river, to the crossing of the latter, and thence to Fort Bridger, (elevation 7,254 feet,) on Black's fork, likewise a tributary of Green river. The amount of work on this section would be considerably less than on the preceding.

From Council Bluffs to Fort Bridger the distance is 942 miles; from Fort Leavenworth 1,072 miles.

The route now ascends the divide between the waters of Green river and those of the Great Salt lake, by the valley of Black's fork, or of one of its tributaries, with grades of 69.5 and 40.3 feet per mile. The summit is a broad terrace at the foot of the Uinta mountains, and has an elevation of 8,373 feet. From this point the line descends over the undulating country separating the Uinta and Bear River mountains, crossing the head of Bear river, and, entering the valley of White Clay creek at its head, follows down that stream to its junction with Weber river.

The Wahsatch mountains now intervene between this plateau country and the Great Salt lake, and the passage through them may be effected by following Weber river, or by ascending to near the sources of the Timpanogos; and descending that stream—both being affluents, directly or indirectly, of the Great Salt lake—the distances are about the same to their common point on that lake.

There are cañons upon both these streams. That of the Timpanogos is 10 miles in length, and narrow, being from 100 to 300 yards in width. It is direct in its general course, but must be bridged at several points, to avoid short curves. The sides are of blue limestone, and will require rock-blasting at some points. The river, 30 yards wide, descends with a powerful current, and, when most swollen, is six feet above its ordinary level.

On Weber river there are two cañons. The upper is rather a gorge or defile, 8½ miles long. The mountains rise to a great height above it, and are rocky and precipitous, and much broken by ravines. The river is winding, and it will be necessary to cross it frequently. The lower cañon, near the borders of the valley of Great Salt lake, is four miles long, direct, with an average width of 175 yards, the stream being 30 yards wide, and impinging frequently with great force against the base of the mountains, which, however, are sufficiently retreating to admit of the practicable passage of a railway.

Entering the valley of Great Salt lake from either this or the Timpanogos cañon, there is no obstacle to the construction of a railway passing by the south end of the lake, and crossing the Jordan, Tuilla valley, and Spring or Lone Rock valley, to its west side.

By the valley of the Timpanogos, the distance from near Fort Bridger to the south end of the Great Salt lake, on the western side of the valley of the Jordan, is 182.55 miles; the greatest grade required, 84 feet to the mile. The amount of work required on this section, excepting that along the cañon, will not, in the opinion of Lieutenant Beckwith, be great.

From the western shore of Great Salt lake to the valley of Humboldt river, the country consists alternately of mountains, in more or less isolated ridges, and of open level plains, rising gradually from the level of the lake on the east, to the base of the Humboldt mountains on the west; that is, from 4,200 feet to 6,000 feet above the sea. West of the Humboldt mountains the country is of the same character, the plains declining until, at the west shore of Mud lake, usually called the foot of the Sierra Nevada, the elevation is 4,100 feet.

The mountains in this space of 500 miles, (by the route travelled 600 miles,) between the Great Salt lake and the foot of the Sierra Nevada, have a general north and south course. Occasionally cross-spurs close in the valleys to the north and south, but more frequently this isolation is only apparent. The mountains are sharp, rocky, and inaccessible in many parts, but are low and easily passed in others. Their general elevation varies from 1,500 to 3,000 feet above the valleys, and but few of them retain snow upon their highest peaks during the summer. They are liberally supplied with springs and small streams, but the latter seldom extend far into the plains. At the time of melting snows there are many small ponds and lakes, but at other seasons the waters are absorbed by the soil near the base of the mountains. Grass is found in abundance upon nearly every range, but timber is very scarce—a small scattered growth of cedar only being seen upon a few ranges. East of the Humboldt mountains the growth of cedars is more abundant, and the grass better, than to the west. The valleys rarely have a width east and west of more than five or ten miles, but often have a large extent north and south. They are irregular in form, frequently extending around the ends of mountains, or uniting to succeeding valleys by level passages. The greater part of the surface of these valleys is merely sprinkled by several varieties of sombre artemisia, (wild sage,) presenting the aspect of a dreary waste. Though there are spots more thickly covered with this vegetation, yet the soil is seldom half covered with it, even for a few acres, and is nowhere suitable for settlement and cultivation. Immediately west of Great Salt lake there is a plain of mud, clay, and sand, impregnated with salt, seventy miles in width from east to west by its longest line, and forty at a narrower part further south, thirty miles of which must be piled for the passage of a railroad across it. A railroad may be carried over this series of valleys and around the mountain masses, at nearly the general level of the valleys.

The route in this manner reaches the foot of the Humboldt mountains, a narrow but elevated ridge, containing much snow during most of the year, and crosses them by a pass nine miles long, about three of which are occupied by a narrow, rocky ravine, above which the road should be carried on the sloping spurs of the mountains on the western descent; elevation of summit 6,579 feet above the sea. At the time when passed, 21st May, snow covered the high peaks above it, and a few drifts extended into the ravines down to the level of its summit.

The descent is now made to the open valley of Humboldt river, which is followed for about 190 miles. The steepest grade proposed in the pass of Humboldt mountain is 89 feet per mile for eight miles, but this can be reduced by gaining distance to any desirable extent.

The Humboldt river, as described by Colonel Fremont, is formed by two streams rising in mountains west of the Great Salt lake. Its general direction is from east to west, coursing among broken ranges of mountains; its length about three hundred miles. It is without affluents, and terminates near the foot of the Sierra Nevada in a marshy lake. It has a moderate current—is from two to six feet deep in the dry season, and probably not fordable anywhere below the junction of the two streams during the melting of the snows. The valley varies in width from a few miles to twenty, and, excepting the immediate river-banks, is a dry, sandy plain, without grass, wood, or arable soil. Its own immediate valley (bottom) is a rich alluvion, covered with blue grass, herds-grass, clover, and other nutritious grasses, and its course is marked through the plain by a line of willow.

Of the three lines from the Humboldt river to the foot of the Sierra Nevada, the best is that by the Noble's Pass road, as it avoids the principal range of mountains crossed on the line followed a few miles south. The line followed crosses two ranges of the general character of the Basin mountains, and reaches the foot of the Madelin Pass of the Sierra Nevada, on the west shore of Mud lake, in a distance of 119 miles, and at an elevation of 4,079 feet above the sea.

In this latitude the Sierra Nevada was found to be a plateau about 5,200 feet above the sea, 40 miles in width from east to west, enclosed at these limits by low mountains, the summits of the passes through which are 400 and 500 feet above the base. The plain is covered with irregular spurs, ridges, and isolated peaks, rising a few hundred feet, limiting it in a north and south direction sometimes to a space of a few hundred yards, and at others to that of ten miles. These spurs, &c., on the eastern portion of the plateau, are sparsely covered with cedar; on the western, heavily covered with pine.

There is no drainage from this plain, the waters of a few small streams and springs forming grassy ponds upon its surface. In its general features it is similar to the Great Basin, excepting that as more rain falls upon it, the vegetation is comparatively luxuriant.

There are two routes by which this plain may be reached from the Great Basin, and the descent made to the Sacramento river. That by the Madelin Pass, the more northern, is most probably the better of the two, and is the only one necessary to be considered. Leaving Mud lake, it ascends by the valley of Smoky creek for three miles, through a narrow gorge (from 100 to 150 yards wide) in an outlying spur of the Sierra Nevada.

After this the route is over more open ground, varying, in degree, to the summit of the passage through the eastern ridge bounding the Sierra Nevada plateau. The pass is thus far of a very favorable character—the length of the ascent is 22.89 miles; the difference of elevation, 1,172 feet; the altitude of the summit, 5,667 feet; and the steepest slope is 75 feet per mile.

The plateau being gained, is crossed by a nearly level line to the low ridge bounding it on the west, the summit elevation of which, 5,736 feet, is attained by following a ravine valley.

The descent to the Sacramento along one of its tributaries is now commenced, and is at first rapid. A cut is proposed at the summit, 120 feet deep, running out to the surface at either end, making a length of four miles, and a grade of 124 feet to the mile for 2.4 miles. It may be preferable to tunnel or to cut only one-half the depth proposed. The open plain of Round valley, on the Sacramento, is reached 15 miles from the summit, (difference of elevation 1,300 feet,) located for one-half that distance on the mountain side, which is broken by ravines.

The route now lies over the smooth plain of Round valley for 15 miles, to the head of the first cañon on the Sacramento. This cañon is a formidable obstacle to be overcome. Its entire length is nearly 14 miles, succeeded by an open valley of similar extent, which is followed by a second cañon, nine miles in length, of the same character as the first. From the mouth of Canoe creek, four miles below the foot of the second cañon, for the space of 96 miles the course of the Sacramento lies entirely through heavily-timbered mountains, which rise precipitously from the river-banks to the height of from 1,500 to 2,000 feet above the stream. Its course is very sinuous, with all varieties of curves greater than a right-angle, and is seldom entirely straight for two miles consecutively. The construction of this portion of the route, 136 miles in length, would be one of no ordinary difficulty or expense under the most favorable circumstances of dense population, and the facilities of railroad construction which it would afford. It is impossible, with the data presented, to form a reliable opinion of its probable cost.

Seventeen miles above Fort Reading the open valley of the Sacramento is attained, over which a railroad may be carried to the bay of San Francisco, 250 or 300 miles distant.

The distance from Fort Bridger to Fort Reading by the line of Lieutenant Beckwith's profile is 1,012 miles; from Fort Leavenworth to Fort Bridger, 1,072 miles—making the whole distance from Fort Leavenworth to Fort Reading, on the Sacramento, 2,084 miles, and to Benicia 2,264 miles.

The distance from Council Bluffs to Benicia by the above route is 2,134 miles.

Using the line along which the route can be located in the Great Basin, about 103 miles shorter than that travelled, the distances become, from Fort Bridger to Fort Reading, 909 miles; from Fort Leavenworth to Fort Reading, 1,980 miles; and to Benicia, 2,161 miles.

The distance from Council Bluffs to Benicia becomes 2,031 miles.

The points of supply for ties, lumber, &c., are at distances apart of 500, 300, 200, and 700 miles, as timber is only found at the eastern extremity of the route, on the Black Hills, Wind River mountains, the Uinta and Wahsatch mountains, and on the western slopes of the Sierra Nevada. The scattered growth of cedar upon the Basin mountains may, perhaps, be found available for ties.

Should the coal-beds of Green river prove to be of such quality and extent as to admit of being profitably mined, the points of supply of fuel—the same as those just designated for lumber—will be importantly increased. Coal may then be had for nearly the cost of mining it at the eastern terminus of the road, for cost of mining near its middle, and at its western terminus for the cost of mining, and freight to that point from Puget sound.

Fuel for working-parties will generally be found contiguous to the route.

The winter climate is known to be severe on the plains east of the Rocky mountains in this latitude. That it is more severe, and of long duration, upon the great table-land of the Rocky mountains, is to be inferred. Lieut. Beckwith found the sun had not yet begun to melt the snow upon the terrace divide on the western border of the plateau, and about 1,000 feet above it, when he crossed the former, on the 10th April. The snow was here from twelve to sixteen inches deep, and had accumulated in deep drifts on the northeast slopes of the hills and ravines. Captain Stansbury found the Uinta mountains covered with snow for a considerable distance from their summits on the 19th August. The quantity of snow that falls upon the great undulating plain between Fort Laramie and Fort Bridger is not exactly known. It is probable that no unusual difficulty may be apprehended from it on this plain, or on the terrace divide, where crossed by Lieut. Beckwith; but the fall of snow in the Wahsatch and other mountains is very much greater, and accumulates in their gorges, ravines, and cañons, to great depths. Apparently, Lieut. Beckwith does not apprehend unusual difficulties from this cause along the proposed railroad route in this region, or in that of the Madelin Pass.

The supply of water upon the Rocky mountain plateau must be very limited at certain seasons of the year: the distances apart of these supplies are not given.

Abundant supplies of water were found by Lieut. Beckwith on the mountains of the Great Basin. The season of the year when he crossed it—the spring—was the most favorable in this respect.

On this route, as on others, from the 98th or 99th meridian to the western slopes of the Sierra Nevada, a distance of 1,400 miles, the soil is uncultivable, excepting the comparatively limited area of the Mormon settlement, and an occasional river-bottom and mountain valley of small extent.

West of the Black Hills the plains are covered with artemisia, rarely furnishing any grazing except along the water-courses—the mountains being generally clothed, to a greater or less extent, with grass. The barren aspect of the Great Basin has been already described. In that desolate region there are but few and very limited areas where the conditions of soil, water, and temperature requisite for cultivation, are found.

The features of this route, favorable to the economical construction of a railroad, are apparent from the description of it which has just been given. Its unfavorable features may be briefly described: as the costly construction, for nearly three hundred miles along the Platte and Sweet Water, in ascending to the summit of the South Pass; in the cañon of the Timpanogos; in the two cañons of the Sacramento, fourteen and nine miles in length; and in the very sinuous course of the river, for the space of ninety-six miles, through heavily-timbered mountains rising precipitously from the stream—the cost of constructing a railroad along which cannot be properly estimated until minute surveys are made.

Although the route passes over elevated regions, the sum of ascents and descents is the next least after that of the 47th parallel, which is to be attributed to the table-land character of the mountain districts.

It partakes of the character of the route near the 47th parallel, in the long and severe winters on the plains east of the Rocky mountains and westward to the Great Basin.

The cost, as estimated in the office, from Council Bluffs to Benicia, a distance of 2,031 miles, is $116,095,000.

The statistics of the route will be found in the table appended.

The survey of the western portion of this route by Lieutenant Beckwith, has resulted in the discovery of a more direct and practicable route than was believed to exist from the Great Salt lake to the valley of the Sacramento. Since his report was made, a brief communication from Brevet Lieutenant Colonel Steptoe, commanding the troops in Utah, has announced the discovery of a still more direct route from Great Salt lake to San Francisco. The new portion of this route passes to the south of Humboldt or Mary's river, and, entirely avoiding the difficulties experienced by travellers along that stream, proceeds to the valley of Carson river, being well supplied with water and grass. From Carson river it crosses the Sierra Nevada by the passes at the head of that river, and descends to the valley of the Sacramento, being practicable throughout for wagons.

In the absence of instrumental surveys affording data for the construction of profiles, no opinion can be formed as to the practicability of this route for a railroad. Should it be found practicable, however, it will lessen the length of the route of the 41st parallel, and still further diminish its difficulties, already known to be less than on any other route except that of the 32d parallel.

ROUTE NEAR THE THIRTY-EIGHTH AND THIRTY-NINTH PARALLELS OF NORTH LATITUDE.

The general consideration that determined the position of the route to be examined near the 38th and 39th parallels of latitude, was its central position geographically, it being about midway between the northern and southern boundary lines of the United States, which is likewise the position, nearly, of the Bay of San Francisco; the two termini of the route, St. Louis and San Francisco, being respectively in latitudes 39° and 38°, nearly. Moreover, a route near these parallels would probably give the shortest road from the Bay of San Francisco to the navigable waters of the Mississippi.

The exploration of the route conducted by Captain J. W. Gunnison, corps of Topographical Engineers, commenced on the Missouri at the mouth of the Kansas, about 245 miles from the Mississippi at St. Louis. The Kansas, and its branch called the Smoky Hill fork, were followed to a convenient point for crossing to the Arkansas, the valley of this latter river having been entered west of the Great Bend and near the meridian of 99°. The route then ascended the valley of the Arkansas to the mouth of Apishpa creek, fifty miles above Bent's Fort; leaving it here, and crossing to the entrance of the Rocky mountains, here called the Sierra Blanca, at the Huerfano Butte, on the river of that name, a tributary of the Arkansas. The elevation at this point is 6,099 feet; its distance from Westport, mouth of the Kansas river, by the railroad route, 654 miles.

Of the several passes through the Rocky mountains connecting the tributaries of the Huerfano with those of the Rio del Norte, but one, the Sangre de Cristo, was found practicable for a railroad, the new and only practicable approach to this pass being explored by Capt. Gunnison. By side location the summit, 9,219 feet above the sea, 692 miles from Westport, was attained, and the descent made to the valley of the Rio Grande with practicable though heavy grades; and thence the grades were favorable to the vicinity of Fort Massachusetts.

The western chain of the Rocky mountains is now to be crossed in order to gain and traverse the basins of the two great tributaries of the Colorado of the West, Grand and Green rivers. For this purpose the valley of San Luis, an extensive, uncultivable plain, covered for the most part with wild sage, was ascended with easy grades to Sahwatch creek, one of whose affluents rises in a pass of the Rocky mountains, here called the Sahwatch mountains, known by the name of the Coo-che-to-pa Pass.

The approach to the summit of the pass, 10,032 feet above the sea, 816 miles from Westport, is not favorable, the pass in this part having a defile character, overhung occasionally by walls of igneous rock. To cross the summit, a grade of 124 feet per mile for several miles, and a tunnel nearly two miles long, are required. The descent, with grades varying from 41 to 108 feet per mile, is by the valley of Pass creek, along which much cutting and filling will be necessary, as the hills are cut by numerous ravines. For 16 miles before the junction of Pass creek with Coo-che-to-pa creek, the former passes through a broken cañon. After following Coo-che-to-pa creek seven miles, the valley of Grand river is attained.

The route follows the valley of this river 173 miles, then crosses the divide to Green river, 68 miles, and by the tributaries of the latter approaches the pass through the Wahsatch mountains. A tunnel three-quarters of a mile long is here required, the eastern approach to which is by means of a grade of 125 feet per mile for 6½ miles, and a descent to the west for 5 miles of 131 feet per mile. Thence westward along the valley of Salt creek for 18 miles the grade is 95 feet per mile, 16 miles of which is through a rocky cañon, intersected by lateral streams. The route then enters the valley of the Sevier, the exploration terminating on this river, 86 miles further on, and 1,348 miles from Westport.

From the western border of the State of Missouri to the Rocky mountains, 650 miles, no timber suitable for railroad purposes will be found, upon which reliance can be placed. From the Coo-che-to-pa Pass to the Great Basin, 500 miles, there is none available on the route, and the nearest supplies on the mountains bordering the Great Basin are in latitudes 40° and 41°.

With building-stone it is about as well supplied as the other routes. Of water there is a sufficient supply, except between Grand and Green rivers, a distance of 70 miles, where, at certain seasons of the year, little or none is found.

The soil west of the meridian of 99° is, under the present meteorological conditions, uncultivable, except in limited portions of river-bottoms and small mountain valleys; these latter, from their great elevation, being better adapted to grazing than agricultural purposes. This description is completely in accordance with the geological formation and meteorological condition; the former, from the meridian of 99° west, being apparently tertiary, excepting in the high mountain passes.

This route may be considered to possess, in common with that of the 41st parallel, the large body of fertile soil in Utah Territory occupied by the Mormons, the area of which is about 1,108 square miles.

The coal field of Missouri lies at the eastern extremity of this route; the indications of coal in the Grand and Green River basins make it highly probable that seams sufficiently thick for profitable mining exist there.

In regard to grade and construction, it is unnecessary to enter into any discussion of that portion of the route from Westport to the Sangre de Cristo Pass. It presents no peculiar difficulties or advantages, but is similar to the routes of the 47th and 41st parallels.

It would appear that the Sangre de Cristo and Coo-che-to-pa Passes are practicable in grade; but the construction of the road through the Coo-che-to-pa Pass, and the western approach to it, would be costly under favorable circumstances of population, &c., not only on account of the tunnel, but of the numerous ravines that are crossed west of the pass, and the cañon that follows.

The following brief enumeration of the character and extent of the difficulties to be encountered between the Coo-che-to-pa Pass and the Great Basin, make it evident that the route must be considered impracticable.

From the head of the cañon on Grand river, not far below the mouth of Coo-che-to-pa creek, to the Uncompahgra river, a distance of 70 miles, the ground is cut up with deep, wide, precipitous ravines, the largest several hundred feet deep. These ravines cannot be turned near the mountains without encountering similar difficulties, and at a cost greater than that of a route along the river. Thus the route is forced upon Grand river, and along its cañon, 60 miles in length, broken and interrupted by the deep ravines already mentioned and numerous smaller gullies. The roadway throughout the greater part of this distance must be blasted out of solid rock, and these wide ravines, from 100 to 200 feet deep, where they cut through the cañon, crossed by viaducts or filling.

Then follow 50 miles to the mouth of Blue river, the construction still of a difficult and costly character, from the cañons of the river and broken nature of the ground. From Blue to Green river is 100 miles, over which the road will require numerous bridges and culverts, and a costly road-bed foundation of broken stone or piling over a clayey soil, which in wet weather is almost impassable.

From Green river to the Wahsatch Pass, about 80 miles, the construction would still be of a costly character, the country being of the same ravine and chasm-like nature as that between the mouth of Coo-che-to-pa creek and Uncompahgra river, though on a smaller scale.

Next follows the Wahsatch Pass, the work in which is difficult and expensive. The greatest grade is 131 feet per mile; a tunnel not quite three-quarters of a mile long is requisite; and finally, a cañon 16 miles long on Salt creek, the walls of which are frequently broken by lateral streams, gives the only route along which the road can be brought, by cutting in solid rock at very great expense.

The difficulties of engineering and the cost of construction of this portion of the route from the Coo-che-to-pa Pass to Sevier river, in the Great Basin, a distance of about 500 miles, would be so great that it may be pronounced impracticable; and it is evident, from the report of Lieutenant Beckwith, that, to use his own language, "no other line exists in the immediate vicinity of this, worthy of any attention in connexion with the construction of a railroad from the Mississippi river to the Great Basin."

It is unnecessary, therefore, to consider the route further, or to enter into any discussion connected with the probable practicability and cost of constructing and working a railroad over other portions of the route where counterbalancing advantages are not found to compensate, in any degree, for the enormous cost of that under consideration.

Laying aside the utterly impracticable nature of this route, the following considerations will show its disadvantages as regards expenses of working, supposing it constructed:

From Westport to the west base of the Un-kuk-oo-ap mountains is 1,323 miles; sum of ascents, 23,190 feet; of descents, 19,052 feet; length of equivalent horizontal line for the route, 2,123 miles.

Of the direct route from the point at the western base of the Un-kuk-oo-ap mountains, near where the survey under Capt. Gunnison terminated, to the Tah-ee-chay-pah Pass, there is no survey or positive information. There is every reason to belive that it is, for the most part, a desert of the same general character as other portions of the Great Basin. Supposing the route to be a straight line, with uniform descent from the Un-kuk-oo-ap mountains to the entrance of the Tay-ee-chay-pah Pass, in latitude 35° 5′, (no pass being known to be practicable to the north of it in this portion of the Sierra Nevada,) the distance will be 430 miles, and the descent 1,830 feet; the equated horizontal distance, 464 miles.

From the entrance of the Tay-ee-chay-pah Pass to San Francisco is 326 miles; sum of ascents, 1,308 feet; sum of descents, 4,608 feet; equated length, 440 miles. Adding these together, with the equated distance from the mouth of the Kansas to the west base of the Un-kuk-oo-ap mountains, we have the total equated distance from Westport to San Francisco, 3,027 miles—the length of the straight horizontal line, which supposes no obstacle to be avoided, being only 1,500 miles.

The distance from Sevier river to Great Salt lake is 120 miles; sum of ascents and descents, 1,600 feet; equated distance, 150 miles; thence to Benicia, by the route near the 41st parallel, explored by Lieut. Beckwith, is 872 miles; sum of ascents and descents, 15,200 feet: making the equivalent horizontal line 1,160 miles; which added to the equated distance from Westport to Sevier river, 2,050 miles, we have a total of 3,360 miles, as the equated distance by this route from Westport to Benicia.

Neither in soil, climate, productions, population, nor in any other respect, does it possess advantages superior to other routes favoring the construction and working of a railroad.

The exploration of this route, conducted by Capt. Gunnison, of the Corps of Topographical Engineers, exhibits the high professional skill and sound judgment which characterized that officer. The extensive and reliable information which he collected, and the exact manner in which his operations were conducted, up to the period when he lost his life in the discharge of his duty, show how thoroughly he would have completed the task he had commenced, and how great a loss the service sustained in his untimely death. Several of his civil assistants fell with him, and the charge of the survey devolved upon Lieut. Beckwith, of the artillery, who has made, from the field-notes left by Capt. Gunnison, a thorough report of his explorations. Satisfied of the impracticability of the line he had traversed, Lieut. Beckwith commenced an exploration eastward from the Great Salt lake, to connect that position with the line of the 41st parallel, and then returning to Salt lake, continued the survey westward to the waters of the Pacific. This work, in all its parts, has been well done, and the topography well represented. More than ordinary credit is due to this officer, as the task performed by him was not in the line of his usual duties, and was executed without the aid of assistants, and with the means left to the party after a season of field operations.

ROUTE NEAR THE THIRTY-FIFTH PARALLEL OF NORTH LATITUDE.

The general features which have determined the position of this route, the exploration of which was conducted by Lieut. A. W. Whipple, Topographical Engineers, are the extension, west and east, of the interlocking tributaries of the Mississippi, the Rio Grande, and the Colorado of the West. It would appear to possess also a greater yearly amount of rain than the regions immediately north and south of it—and, as a consequence, a better supply of fuel and timber.

Commencing at Fort Smith, on the Arkansas river, about 270 miles from the Mississippi at Memphis, the route, as far as the Antelope Hills on the Canadian, a distance of 400 miles, may follow either the valleys of the Arkansas and Canadian, or a shorter line perhaps, but over more ground, south of the Canadian, this latter route branching again, and following either the valley of the Washita, or the dividing ridge between it and the Canadian.

From the Antelope Hills the route continues along the bottom of the Canadian, on the right bank, to the mouth of Tucumcari creek, about 250 miles, and ascends by the valley of Tucumcari, or by that of Pajarito creek, to the dividing-ridge between the Canadian and the Pecos rivers, elevation about 5,543 feet, and enters the valley of the latter. It follows this valley until, by means of a tributary, it rises to the high table-land, or basin, lying east of the Rocky mountains, elevation about 7,000 feet, crosses the elevated Salinas basin, 30 miles wide, the lowest point being 6,471 feet, and gains the divide in the Rocky mountains, elevation about 7,000 feet; from which point it descends to Albuquerque, or Isleta, on the Rio Grande, through the San Pedro Pass; or it may descend to the Rio Grande by the valley of the Galisteo river, north of Sandia mountain. A third route is indicated along the valley of the Pecos to its headwaters; thence to an affluent of the Galisteo; and thence, as before, to the Rio Grande.

Isleta, on the Rio Grande, is 854 miles from Fort Smith, and 4,945 feet above the sea.

Crossing the ridge separating the Rio Grande from the Puerco, the route follows the valley of its tributary, the San José, to one of its sources in a pass of the Sierra Madre, called the Camino del Obispo; at the summit, (elevation 8,250 feet,) a tunnel three-fourths of a mile long, at an elevation not less than 8,000 feet, is required, when the descent is made to the Zuñi river and near the Pueblo of Zuñi; the route then crosses, over undulating ground, to the Puerco of the West, at the Navajo spring.

Another route across the Sierra Madre, about twenty miles further north, was examined by Mr. Campbell, which is apparently far more favorable. The profile, however, is not from reliable instrumental examination. The height of the summit is about 7,750 feet above the sea. The Puerco of the West heads in this pass, and the route follows the valley of this stream, (intersecting the other line at Navajo spring,) to its junction with the Colorado Chiquito; then the valley of that stream to the foot of the southeastern slopes of the San Francisco mountains, elevation 4,775 feet; distance from Fort Smith 1,182 miles, and from the crossing of the Rio Grande 328 miles. Here it ascends to the dividing ridge between the waters of the Gila on the south, and of the Colorado of the West on the north, and continues (or nearly so) upon it for about 200 miles, to the Aztec Pass, elevation 6,281 feet; distance from Fort Smith 1,350 miles. The highest point reached upon this undulating ridge is 7,472 feet, at Leroux's spring, at the foot of the San Francisco mountain. From the Aztec Pass, the descent to the Colorado of the West is made by a circuitous route northward along valleys of its tributaries, the largest and last being Bill Williams's fork, the mouth of which, on the Colorado, is 1,522 miles from Fort Smith, and at an elevation above the sea of about 208 feet.

The Colorado is now ascended 34 miles, when the route, leaving it at the Needles, follows what was erroneously supposed to be the valley of the Mohave river, but which proved to be the valley of a stream, dry at the time, whose source was in an elevated ridge, which probably divides the Great Basin from the waters of the Colorado. The summit having been attained, at an elevation of 5,262 feet above the sea, the descent is made to Soda lake, the recipient at some seasons of the waters of the Mohave river, 1,117 feet above the sea, with an average grade of 100 feet to the mile for 41 miles—the steepest grade yet required on this route. From Soda lake the ascent to the summit of the Cajon Pass, elevation 4,179 feet, in the Sierra Nevada, is made by following the valley of the Mohave river. The summit of this pass, by the line of location, is 1,798 miles from Fort Smith, and 242 from the point of crossing the Colorado. Here a tunnel of 2½ or 3$\frac{4}{10}$ miles through white conglomerate sandstone is required, descending to the west with an inclination of 100 feet to the mile, which grade will be the average for 22 miles into the valley of Los Angeles, if the broken character of the hills should be found, upon careful examination, to admit of such side location as would reduce to that degree the natural grades varying between 90 and 171 feet per mile. Thence to the port of San Pedro the ground is favorable for location.

The principal characteristics of this route, in comparison with others, are, probably, its passing through or near more numerous cultivable areas, its more abundant natural supply of water as far west as the Colorado, and the greater frequency and extent of forest growth on the route between the Rio Grande and the Colorado. These two latter characteristics entail a third, however, of an unfavorable nature—the large sum of ascents and descents.

Near the meridian of 99° the change from fertile land to uncultivable is complete, excepting in the river bottoms, which are more or less fertile. Some portions of the upper valley of the Canadian, the upper valley of the Pecos, the valleys of the Rio Grande, Zuñi, Colorado Chiquito, San Francisco, Colorado of the West, and its tributaries, possess a fertile soil, requiring generally irrigation to make it productive. That portion of the southwest corner of the Great Basin traversed by this route, and over which the explorations of Lieut. Williamson also extended, is well constituted for fertility, its barrenness resulting from the absence of rain. Generally the uncultivable plains have an abundance of nutritious grass, though there are extensive tracts where little or none is found.

The route may be considered sufficiently well supplied with good building-stone, since sandstones suitable for the bridge-building required are reported to exist in the generally soft trias formation, extending from Delaware mountain, on the Canadian, to the Rocky mountains, a distance of 600 miles.

Forest growth, furnishing timber of size suitable for ties and lumber for railroad uses, is found in the following localities: continuously on the route east of longitude 97°; in or near the Pecos valley; in the Rocky mountains and Sierra Madre; in the Mogollon mountains, (south of the route,) in which the Colorado Chiquito and some of its tributaries rise; on the slopes of the San Francisco mountain; and continuously, with short intervals, for more than 120 miles; and on the Sierra Nevada. The distances apart of these points of supply are respectively 540 miles, 100 miles, 150 miles; from the Sierra Madre to San Francisco mountain, 250 miles; then for a space of about 120 miles the supply may be considered continuous; thence to the Sierra Nevada, 420 miles. If the road be built from the two termini, the greatest spaces over which ties, lumber, &c., must be brought by it are 400 and 500 miles. The route, therefore, in comparison with others, is favorably circumstanced in this respect.

The same localities will supply fuel; and, in addition, the coal-fields of Delaware mountain will furnish the eastern portion of the route where wood cannot be economically used. It is reported that coal exists in several localities in the Rocky mountains, both east and west of the Rio Grande, near this route, but there is no positive and reliable information that it has been found in sufficient quantities for profitable mining.

The route for 540 miles east of the Sierra Nevada must receive its fuel from the ports of the Pacific.

Over portions of this route, as upon all others, no fuel whatever, not even sufficient for working parties, will be found. The greatest distance over which this total absence of fuel exists, is between the Colorado and Mohave rivers, 115 miles.

The exact distances over which water is not found at certain seasons are not stated.

Between the 100th meridian and the Pacific there are spaces destitute of it, where, from the known character of the geological structure, there is no doubt that sufficient supplies can be obtained either by deep common wells, artesian wells, or reservoirs.

These more abundant supplies of timber and water, west of the Rio Grande, are attained at the expense of great elevation and somewhat rugged ground.

The Galisteo Pass in the Rocky mountains, and the passes in the Sierra Madre, being wide openings, or valleys, rather than mountain passes, no difficulty need be apprehended from snow, even if it fell to greater depths than those known; over the remainder of the route no difficulty from this cause is to be met with.

The sum of the ascents from San Pedro to Fort Smith is 24,641 feet; of descents, 21,171 feet; equivalent, in the cost of working the road, to an increased horizontal distance of 924.5, which added to the length of the line of location, 1,892 miles, gives for length of equated distance 2,816 miles.

The general features of the country indicated lines for examination at more than one point, which will probably greatly improve the route by reducing the ascents and shortening distances. The party was, however, unable to examine them.

The heaviest grades that will probably be required on the route from Fort Smith to San Pedro, do not equal those in use on the Baltimore and Ohio railroad.

The description of the topographical features of the route is not sufficiently minute to enable one to form a satisfactory opinion of the difficulties of ground to be encountered, and, consequently, of the probable cost of the formation of the road-bed. Lieut. Whipple assimilates the several portions of the route to roads already built, possessing, as nearly as possible, similar features and difficulties.

Four hundred and eighty (480) miles of the route are assimilated to the Hudson River railroad, 151 miles to the Worcester and Albany railroad, (Western railroad,) and 374 miles to the Baltimore and Ohio railroad—making 1,005 miles assimilated to railroads among the most costly that have been constructed in the United States.

The impression given by the description of the route in the report induces the opinion that the ground is more favorable than the comparison of Lieut. Whipple supposes.

Assuming this assimilation to be correct, and bringing the estimate to a uniform standard of increased cost over eastern prices and of equipment, the estimated cost of the route from Fort Smith to San Pedro becomes $169,210,265.

This estimate is believed to be, as above stated, in excess; but the data for reducing it have not yet been reported to the department.

Should it be desired to reach San Francisco by the Tulares and San Joaquin valleys, the route should leave the Mohave valley some 30 miles before reaching the entrance to the Cajon Pass, 1,768 miles from Fort Smith—elevation about 2,555 feet—and proceed across the southwest corner of the Great Basin towards the Tah-ee-chay-pah Pass, reaching its entrance at an elevation of 3,300 feet, in a distance of about 80 miles. The route from this point is coincident with that hereafter described for the 32d parallel.

The sum of ascents from San Francisco to Fort Smith, by the route from Mohave river to Tayee-chay-pah Pass, is 25,570 feet; of descents, 25,100 feet; the equivalent in miles of horizontal road is 963 miles, which added to the location-distance between those two points, 2,174 miles, gives for equated length of road 3,137 miles.

The exploration of the route by Lieut. Whipple, and his report thereon, are entitled to the highest commendation, for the completion of the work in all its parts, the full and exact observations which he made for the determination of longitudes and latitudes, and the wide range of scientific research which he instituted into all the collateral branches connected with the question which his exploration was designed to solve.

ROUTE NEAR THE THIRTY-SECOND PARALLEL OF NORTH LATITUDE.

Among the considerations which determine the general position of the route near the 32d parallel, are the low elevation of the mountain passes in this latitude, and their favorable topographical features, as well as those of the table-lands, extending over more than 1,000 miles of the route; the favorable character of the surface generally, on the route, by which the most costly item of construction in railroads, the formation of the road-bed, is, in a great measure, avoided; the shortness of the line, 1,600 miles, from the navigable waters of the Mississippi to the Pacific, and the temperate climate on the elevated portions in this southern latitude.

The explorations made upon this route are, from Preston, on Red river, to the Rio Grande, by Capt. John Pope, Topographical Engineers; from the Rio Grande, near Fort Fillmore, to the Pimas villages, on the Gila, by Lieut. John G. Parke, Topographical Engineers. From the Pimas villages to the mouth of the Gila, the reconnaissance in New Mexico and California of Major W. H. Emory, Topographical Engineers, in 1846, has been used; and from the mouth of the Gila to San Francisco, the exploration of Lieut. R. S. Williamson, Topographical Engineers, has furnished the data.

Fulton, on the Red river, about 150 miles from the Mississippi, may be considered the eastern terminus of the route, although the examination of Capt. Pope extends only to Preston, 133 miles further west. A direct line from Fulton to the point on the eastern border of the Llano Estacado selected by Capt. Pope for crossing it, would give more favorable ground than that traversed by him between Preston and this point; the latter in a distance of 352 miles gives generally easy grades and cheap construction through a country alternately wooded and open, abundantly supplied with water and fuel, and with forest growth suitable for ties and lumber for two-thirds of the length. From Fulton to the eastern border of the Llano Estacado is 485 miles, 370 of which are wooded.

The exploration of Capt. Pope comprised three distinct belts of country, the first of which has been just described above. The second is the Llano Estacado, whose mean elevation is 4,500 feet, the smooth surface of which along the route proposed, 125 miles from the eastern border to the Pecos river, presents in this respect great facilities for the construction of a railroad. It is, however, at certain seasons of the year destitute of water, is scantily supplied with grass, and not a single tree is to be seen upon it. Its geological formation is such as to render the success of obtaining water by artesian wells, at moderate depths, highly probable. During, and for some time subsequent to the rainy season, there are here, as on most other arid plains, numerous ponds, the contents of which might be collected in reservoirs; but the distance from the Colorado Springs to the Pecos, 125 miles, is not so great as to form a serious obstacle to the working of a railroad.

Between the Pecos and the Rio Grande, 163 miles, three mountain chains rise from the table-lands, the Guadalupe, Hueco, and Organ mountains. The Guadalupe mountain is crossed without a tunnel, elevation of summit 5,717 feet, and with a grade of 108 feet to the mile for 22 miles. A high viaduct and heavy cutting and filling for three miles near the summit, form the costly and difficult part of the pass. The Waco Pass is still more favorable, the greatest grade being about 80 feet to the mile; the elevation of the summit, 4,812 feet. The Organ mountain is turned just before reaching the Rio Grande at Molino and El Paso.

A peculiarity of the mountains in the western part of the continent, in this and other latitudes, is, that they have no intervening deep secondary valleys between the main chain and the plains. Over the usually uniform and smooth surface of these last, the general elevation of which, between the Pecos and the Rio Grande, is from 4,000 to 4,500 feet, the valley of the Rio Grande is attained near Molino, at an elevation of 3,830 feet, and at a distance of 787 miles from Fulton.

The region between the Rio Grande and the Pimas villages on the Gila, just above which point the latter leaves the mountain region, may be described as a great plain, interrupted irregularly and confusedly by bare, rugged, abrupt, isolated mountains or short ranges, around or through the passes in which a railroad may be constructed with quite practicable grades. The mean elevation of this plain, or series of basins into which the ridges divide it, is about 4,100 feet; the mean elevation of the summits of the passes through the ridges is 4,700 feet, the highest, through the Chiricahui range, being 5,180 feet. Except through the passes, the surface is so smooth as to require but little preparation to receive the superstructure of a railroad; and even in the two most difficult of the passes, the natural slope of the ground may be used for a railroad until the construction of the road reduces the cost of materials and supplies to the lowest rates. In one of these two passes (the Chiricahui) the steepest natural slope is 194 feet per mile for 2¼ miles. In the second pass the steepest natural slope is 240 feet per mile for three-fourths of a mile. Both these grades are within the power of a thirty-ton engine, carrying 200 passengers and baggage.

In one case deep cutting in rock, or a tunnel near the surface, at the summit, with heavy side cutting and high embankments for short distances; and, in the other, a short cut of 60 feet, probably through rock, are proposed by Lieut. Parke, to attain grades of 46 feet and 90 feet per mile, or less by increasing distance.

The great difficulty experienced in crossing this district is in the long distances over which no water is found at certain seasons. The survey by Lieut. Parke was made during the dryest season of the year, and, irrespective of the springs found at intermediate points, the whole distance between the two rivers, Rio Grande and Gila, may be divided into five spaces, varying from 80 to 53 miles in length, at the termination of which large permanent supplies of water are found at the most unfavorable season of the year.

These spaces and points are—

From the Rio Grande to the Rio Mimbres	71	miles.
From the Rio Mimbres to the stream of the Valle de Sauz	72	"
From the Valle de Sauz to the San Pedro	80	"
From the San Pedro to Tuczon	53	"
From Tuczon to the Gila	79	"

Not counting the stream of the Valle de Sauz, the distance from the Rio Mimbres to the San Pedro is 152 miles; which distance is not so great that railroad trains could not cross it without water, special arrangements having been made for the purpose. But this is the worst aspect of the case. At other seasons the supply of water is more abundant, and lakes and ponds are formed upon the plains, which may be drained into tanks; and the geological formation is such as to indicate the existence of sufficient supplies of water beneath the surface, which may be brought to it by artesian wells.

The line proposed by Lieut. Parke leaves the Rio Grande near Fort Fillmore, 35 miles from Molino, between which points the river, where confined to one channel, is about 300 yards wide, crosses the district just described, and enters the valley of the Gila near the Pimas villages, the elevation above the sea being 1,365 feet. The route then follows this river to its junction with the Colorado, a distance of 223 miles, with a general slope of 5.6 feet per mile. The Gila, in this distance, flows through a plain with occasional mountains, ridges, and peaks; its valley is highly favorable to cheap construction from its generally smooth surface, and from not being liable to freshets.

From the point now attained, the nearest port in our territory is San Diego, but the passes of the intervening Coast range are very difficult, if not impracticable, and the route is forced northward to the San Gorgonio Pass, which is much the most favorable of the passes in the Coast range explored by Lieut. Williamson for this route. It is an open valley, from two to five miles wide, the surface smooth and unbroken, affording, in its form and inclination, every facility to the building of a railroad. The entrance of this pass is 133 miles from the mouth of the Gila, in a straight line over the Colorado desert, a smooth and nearly horizontal plain, requiring but little preparation for the superstructure of a railroad. Thirty-five miles of this is a gravel plain; the remainder is alluvial soil, which only needs irrigation to be highly productive. On this latter soil, water is found at a depth of 30 feet.

The steepest natural slope, in ascending to the summit of this valley pass, (elevation 2,808 feet,) is 132 feet per mile for two miles.

San Diego and San Pedro can be reached by lines of about equal length from the San Gorgonio Pass. To the former, the first section of the route to San Luis Rey (about 75 miles long) would pass through a country generally favorable to the construction of a railroad, being a plain with numerous hills from 500 to 1,000 feet high, irregularly distributed on its surface, between and around which a road may be carried with favorable grades. Between San Luis Rey and San Diego, however, about 40 or 45 miles, the coast is cut into numerous deep intricate gullies by the drainage of the plain.

To San Pedro, about 125 miles, the route lies almost wholly over the same description of ground as that constituting the first section of the San Diego route, and avoids the obstacles presented by the second. It is, therefore, assumed that the terminus of this route should be at San Pedro, the point which it has now reached. It may, however, be proper to remark that San Pedro is an open roadstead, and would require the construction of a breakwater to constitute it a safe harbor.

From the report of Capt. Pope, it would appear that the belt of fertile land which lies on the west side of the Mississippi throughout its length, extends on this route nearly to the headwaters of the Colorado of Texas, in about longitude 102°—that is, about three degrees further west than on the more northern routes. The evidence adduced in support of this opinion is not, however, conclusive; and, until it is rendered more complete, the fertile soil must be considered in this, as in other latitudes, to terminate about the 99th meridian. Thence to the Pacific slopes the route is over uncultivable soil, though generally grassed, the exceptions being, as on the route of the 35th parallel, in portions of the valleys of the Pecos, Rio Grande, Gila, and Colorado of the West. The table-lands and mountain slopes are usually well covered with grama-grass, and in New Mexico have supported immense herds of cattle. There are exceptions to this, however, on the greater portion of the Llano Estacado, on portions of the plains between the Rio Grande and the Gila; and (comprised in that space) from Tuczon to the Gila, 80 miles, there is no grass on the route travelled, nor is it to be found on the Lower Gila valley; occasional patches of bunch-grass only being found on the plain, and a species of grama-grass sometimes upon the mountain sides. No grass is found on the Colorado desert, 135 miles along the line of location.

The length of the route through this generally uncultivable soil is 1,210 miles. Upon descending from the summit of the San Gorgonio Pass, on the route to San Pedro, the soil is fertile, and either well watered or can be irrigated.

The climate throughout the route is salubrious, the heat due its southern latitude being moderated by the elevation of the table-lands. On the Colorado desert it is torrid, but not unhealthy, and much of the country west of the Sierra Nevada and Coast range is celebrated for health and agreeableness.

The principal characteristic of this route is the great extent of high, arid, smooth, and nearly horizontal table-lands which it traverses, reaching an elevation of 4,000 feet upon the dividing ridge between the Brazos and Colorado rivers of Texas, near which elevation it continues until it descends from the pass of the Sierra de Santa Catarina to the Gila river, a space of nearly 600 miles. The elevation at the summit of the Llano Estacado is 4,700 feet, and in the passes of the Guadalupe and Hueco mountains, east of the Rio Grande, 5,700 and 4,800 feet, respectively. Between the Rio Grande and the Gila, the greatest elevation, which is twice attained, is 5,200 feet; the mean elevation, before the descent to the Gila is commenced, being 4,100 feet. From the eastern edge of the Llano Estacado to the pass of San

Gorgonio, 1,052 miles, the route crosses three rivers, the Pecos, the Rio Grande, and the Great Colorado of the West. The peculiar features of the arid region over which the route lies from the eastern edge of the Llano Estacado to the summit of the San Gorgonio Pass, prove, when closely examined, to be most favorable to the construction of a railroad, since they obviate to a great degree the necessity of the most costly item of railroad construction, the preparation of the road-bed for the superstructure; this preparation, with few and limited exceptions, throughout a distance of about 1,000 miles, having been already made by nature. This item amounts to from one-half to three-fourths of the whole cost of a railroad. Draining and ballasting are also dispensed with at the same time. Over the remaining portions of the route, the ground is generally favorable to the construction of the road-bed. The mountain passes are, of their kind, highly favorable, those west of the Rio Grande requiring no difficult engineering for location through them, and but little rock excavation or expensive embankment and side-cutting. The Guadalupe and Hueco Passes are more difficult.

The most unfavorable supposition for supplies of ties and lumber for the construction of that portion of the route between the eastern limit of the Llano Estacado and the summit of the San Gorgonio Pass, 1,052 miles, is that they are to come from either end of the road, from 300 miles east of the Llano Estacado, and from the port of San Pedro on the Pacific, 1,400 miles apart.

It is supposed that the road is to be built from both ends, in sections not greater than 50 miles each, and made to aid in building itself, transporting its own material, &c., so far as the proper adjustment of economy of time and means will admit; this would bring the mean cost of lumber over this distance of 1,052 miles to $52½ per 1,000 feet, and the mean cost of ties to $1,760 per mile.

The worst case having been examined, it remains to be said that ties and lumber can be obtained on and near this portion of the route from the Guadalupe and Hueco mountains, from the headwaters of the Rio Mimbres, from the Pinal Lleno, from the Salinas river (tributary of the Gila) and headwaters of the San Francisco, and from the San Bernardino mountains of the Coast range; which sources of supply, the length apart of the most distant being 500 miles, may be found to materially obviate the necessity of transporting lumber from the two ends of the road.

The coal of the Brazos and that from Puget sound may be used over the 1,200 miles from San Pedro, to within 200 miles of the Brazos, at a mean cost per ton of $16.

The portions of the route where unusual means must be resorted to for supplies of water, have already been pointed out. Under the most unfavorable suppositions, the cost per mile, over these portions, of obtaining water by artesian wells, will not probably exceed $1,000, an expenditure greatly overbalanced by the saving in road-bed formation, from the regularity and smoothness of surface of the arid regions.

The mode and probable cost of obtaining water at short distances in these dry regions, by artesian wells, reservoirs, and deep common wells, are discussed in the accompanying detailed reports. The practicability of the method by artesian wells is now being subjected to trials.

If these should fail, of which, however, in the Llano Estacado, there is little probability, the permanent streams and large springs are sufficiently near for the purposes of a railroad; and since its construction over these districts will require small working parties, the expense of supplying them with water and fuel, when necessary, will not largely increase the cost of construction. It is probable that the region between the Rio Grande and the Gila, 350 miles by the route explored, is more arid than corresponding regions on the more northern routes, but the construction of works of an unusual kind on railroads for supplies of water, are as essential on all these routes as upon that now under consideration.

The length of this route from Fulton to San Pedro is	1,618 miles.
The sum of the ascents and descents	32,784 feet;
To overcome which is equivalent, in the cost of working the road, to traversing a horizontal distance of 621 miles; and the equated length of the road is	2,239 miles.
The estimated cost is	$68,970,000

EXTENSION OF THE ROUTE OF THE THIRTY-SECOND PARALLEL TO SAN FRANCISCO.

For a connexion with the Bay of San Francisco, the most direct route from the San Gorgonio Pass would be through one of the passes leading from the plain of Los Angeles to the valley of Salinas river. The practicability of these passes is yet to be determined, and an exploration is now being made for this purpose. With the information now possessed, the Bay of San Francisco must be reached by crossing the Coast range to the Great Basin, passing over its southwestern extremity, then crossing the Sierra Nevada and descending to the Tulares valley.

The best pass by which to reach the Great Basin is the "New Pass," made known by Lieut. Williamson's explorations.

Descending from the summit of the San Gorgonio Pass to the town of San Bernardino, 24 or 25 miles distant, with natural slopes less than 80 feet per mile, excepting for 1.3 mile, where the slope is 127 feet per mile, the route to the Mission and Low Pass of San Fernando (about 100 miles from the summit of San Gorgonio) is over a country giving gently undulating grades, and in other respects favorable to construction, in fertile soil, building-stone, water, and fuel.

The San Fernando Pass is about eight miles through. Its summit has an elevation of 1,949 feet. A tunnel is required one-third of a mile long, through soft sandstone, 203 feet below the summit. An ascent of 620 feet is made on the south side, with grades of 155 feet per mile for four miles along the natural slopes, which cannot be reduced by side location without great expense, and a descent of four miles of 115 feet per mile, with heavy side-cutting in earth on the north side. The ascent to the New Pass in the valley of Santa Clara is now begun, and with a cut of 50 feet for a short distance at the summit in drift, the summit is attained in 29 miles over natural slopes without side location, and with grades varying from 55 to 105 feet per mile. For the space of one mile on the ascent, the mountains close in precipitously, and the streams wind abruptly; and it may be necessary here to cut two or perhaps three short tunnels, from 100 to 300 feet long, through slaty granite. The elevation of the summit is 3,164 feet. Descending to the Great Basin, cutting and filling will be required for two or three miles to adjust the natural slope to the grade west of the summit. After that, and until descending into the Tulares valley by the Tah-ee-chay-pah Pass, a distance of about 70 miles, the ground will require little preparation for the superstructure. The lowest level descended to in the Great Basin is about 2,900 feet.

The Tah-ee-chay-pah Pass, first explored throughout by Lieut. R. S. Williamson, is the most favorable in this part of the Sierra Nevada. Its summit is a nearly horizontal prairie for 7½ miles. The elevation of its entrance from the Great Basin is 3,300 feet, from which the natural slope ascends at the rate of 22 feet to the mile for 12 miles, then at 80 feet per mile for 9 miles, to the prairie summit.

The descent to the Tulares valley is 15½ miles by the natural slopes, which vary from 153 to 192 feet per mile, a side location in earth-cutting giving an average grade of 144 feet per mile for 17 miles, which may be reduced still further by an extension to 21 miles—the Tulares valley being entered at an elevation of 1,489 feet. There are two intervals of 13 and 17 miles in the Great Basin where there is no water. Artesian wells here, as in the similar formations between the Rio Grande and the Gila, will probably reach supplies at moderate depths. Deep common wells may be successfully resorted to.

The natural slopes of the three passes just considered are within the power of a 30-ton engine with a load of 200 passengers, each with 100 pounds of baggage.

Supposing 20-ton engines used, and that they carried the maximum loads adapted to the other portions of the road, where the greatest grades are 40 feet to the mile, it would be necessary to divide this load into three parts to pass a grade of 150 feet per mile; and the grades being brought to that, its disadvantage consists in the expense of two additional engines worked through the passes.

From the head of the Tulares valley, the navigable waters of the Bay of San Francisco may be reached in several ways.

The eastern side of the Tulares and San Joaquin valleys is intersected by numerous streams from the Sierra Nevada. The western is bounded by the Coast chain, and has few streams. That part of the Tulares valley between Kern and San Joaquin rivers, a space of 150 miles, having a soft alluvial soil, is, at certain seasons, miry; a road, therefore, extending through it, should keep near the foot-slopes of the mountains. From the Tah-ee-chay-pah Pass to the best point of crossing Kern river, 21½ miles, the route passes over a dry, dusty plain, destitute of water and fuel, the soil of which is not well constituted for fertility.

From the crossing of Kern river to the second crossing of the San Joaquin, near Grayson's, the numerous river-beds or bottoms should be crossed on piles, the spaces varying from 50 to 300 feet—the greatest width to be spanned not exceeding 100 feet. From Tah-ee-chay-pah Pass to the Straits of Martinez, the location distance would be 288 miles. The most direct route to San Francisco from the Tah-ee-chay-pah Pass will be found through one of the passes known to exist in the mountain range separating the Tulares and San Joaquin valleys from those of the Salinas and San José rivers. The distance through it is about 10 miles; the elevation of the passes about 600 feet. From Tah-ee-chay-pah Pass the route should cross to the western side of the Tulares valley, around the head of the lakes, and enter the Salinas valley as soon as practicable.

The soil of the Tulares valley, north of Kern river, and of the San Joaquin valley, is well constituted for fertility, and needs merely the proper amount of water to be highly productive. Sufficient water and fuel for working parties can be found at convenient distances on this section, (excepting where it crosses the Great Basin, and approaching Kern river; the amount of deficiency on these portions having been already given.) Lumber and good building-stone are found at various points in the mountains, accessible from their foot-slopes. For fuel for locomotives, the coal of Puget sound and Vancouver's island *must probably be depended upon.*

The topographical features of this extension of the route are, with the exception of the mountains, favorable to cheap construction. The mountain passes are likewise of a favorable character, their only objectionable feature being their high grades. The nature and extent of this objection has been already stated, and, it is seen, is not serious.

From Fulton to San Francisco the distance is 2,039 miles; the sum of the ascents and descents 42,008 feet, which is equivalent to 795 miles; and the equated length of the road is 2,834 miles; the estimated cost is $93,120,000.

To Lieut. Williamson, assisted by Lieut. Parke, was intrusted the survey of a route from the Bay of San Francisco to the junction of the Gila and Colorado rivers, connecting with the ports of San Pedro and San Diego on the one side, and on the other with the most practicable mountain passes. His work has been thoroughly and handsomely executed, presenting much new and valuable information of the mountain passes on the southern portion of the Sierra Nevada and Coast range. The geological examination, made under his orders, is highly creditable and instructive.

The examination of the middle section of the route of the 32d parallel, by Lieut. Parke, was very thorough, and highly creditable, though executed with small means; and his report very satisfactorily exhibits the character and essential features of the country over which he passed. The scientific labors of the boundary survey, which had been previously performed in this region, rendered it unnecessary to do more than make what may be strictly called a railroad exploration.

The examination of the eastern portion by Capt. Pope, assisted by Lieut. Garrard, of the dragoons, was made under the most disadvantageous circumstances, the party having been organized at a remote point, where neither instruments, nor assistants specially instructed in the scientific branches connected with the survey, could be procured. It was, however, creditably performed, and satisfactorily exhibits the topography and general character of the country along the line surveyed.

CONCLUSION

To aid in a comparison of the several routes, reference is made to a table prepared by Capt. A. A. Humphreys, and hereto appended.

With regard to the estimates of cost, although believed to be as accurate as can be made under present circumstances, they are to be considered as intended not so much to show the absolute sums of money which would build the several roads, as to represent the relative quantities of materials and labor required for the purpose. If now tested in the actual construction of any one of the roads, they will doubtless be found to contain many errors; but as the same data have been assumed on all the routes, the same amount of error will probably be found in each, and the actual expense will thus preserve the same proportion.

With regard to the equated lengths of the several roads, or, in other words, the influence of ascents and descents upon the expense of working, it is proper to direct attention to the remarks of the engineer, appended to the tables, in which he states that, on all the routes, the amount reported will be subject to increase when the minor undulations of the ground shall be measured; and this increase will be greatest on those routes and in those portions where the features of the country are less regular—that is, where there are most of such minor undulations to be measured. The equated distances also affect the cost of working a road only under certain circumstances, which may or may not exist on the contemplated route.

A comparison of the results stated above, and of those exhibited in the tables referred to, conclusively shows that the route of the 32d parallel is, of those surveyed, "the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean."

This is the shortest route; and not only is its estimated cost less by a third than that of any other of the lines, but the character of the work required is such that it could be executed in a vastly shorter period. It is obvious that a road on any of these routes, with the exception perhaps of the 47th parallel, must be built continuously from the two extremities, and an obstacle that arrests its progress at any point defers the commencement of all the work in advance. The tunnels and much of the other work on the more northerly routes in the most desolate regions are such as could not be commenced until a road was constructed up to those points, and would then require a long period for their completion.

On the southernmost route, on the contrary, the progress of the work will be regulated chiefly by the speed with which cross-ties and rails can be delivered and laid, the nature of the country being such that throughout the whole line the road-bed can easily be prepared in advance of the superstructure. The few difficult points, such as the Pass of the Guadalupe and Hueco mountains, and the passes between the Rio Grande and Gila, would delay the work but an inconsiderable period.

This peculiarity of the ground presents another advantage in the fact that temporary tracks could be laid upon the natural surface of the earth to almost any extent, to serve for the transportation ot materials and supplies.

The climate on this route is such as to cause less interruption to the work than on any other route.

Not only is this the shortest and least costly route to the Pacific, but it is the shortest and cheapest route to San Francisco, the greatest commercial city on our western coast; while the aggregate length of railroad lines connecting it at its eastern terminus with the Atlantic and Gulf seaports is less than the aggregate connexion with any other route, as will be seen by reference to the appended table B.

With regard to the circumstances which affect the cost of working and maintaining the road, they are more favorable than on any other route. In this dry climate the decay of cross-ties and other timber would be very slow, and the absence of severe frost would have a most important influence upon the permanence of the road-bed, and heavier grades could be adopted than in a climate where ice and snow prevail.

The snows on all the other routes, except that of the 35th parallel, could not fail at certain seasons to suspend the working of the road, for on all, such snows are known to have fallen as would interpose an effectual barrier to the passage of trains. Such an occurrence in this desolate region would be attended with more serious consequences than in inhabited districts.

In only one important respect is this route supposed to be less favorable than some of the others, and that is, in the supply of fuel. The difference, however, in favor of the others is not great, unless the existence of coal at certain points along those routes where it is indicated should be verified by further examination. The cost of fuel is about one-fifth of the whole expense of maintaining and working a railroad.

The grades of the several routes, and other similar information, will be found upon the sheets of profiles compiled in the office.

In the determination of the explorations proper to be made—in the examination of the reports of the suveying parties, the preparation of the profiles, and of a general map to exhibit, in their geographical relation to each, all the routes of which an instrumental examination had been made—I am greatly indebted to the assistance which has been rendered by the officers of the corps of topographical engineers employed in the office established here in connexion with the explorations directed by the act; and I will here especially acknowledge my obligations to Major W. H. Emory, whose extensive knowledge of the western regions of our country, no small part of which he had actually explored, and whose sound judgment in all things connected with topographical reconnaissances and field operations, gave me important aid in the organization of the work and the subsequent office examinations necessary to systematize its results.

When, in August, 1854, Major Emory's duties as commissioner to run the boundary-line between Mexico and the United States separated him from further connexion with these explorations, he was succeeded by Capt. A. A. Humphreys, whose high scientific attainments and power of exact analysis had been manifested in several important positions which he had held, and are further shown in the able and comprehensive examination, herewith submitted, of the reports of the several parties of exploration.

Lieut. G. K. Warren, first under Major Emory, and subsequently under Captain Humphreys, has been specially intrusted with the preparation of the material and the construction of the general map, together with the compilation of profiles of all the routes which had been instrumentally surveyed, and the collection of all general information which would aid in the determination of the question before the department. In these duties he has recently had the zealous and efficient aid of Lieut. H. L. Abbott.

These laborious and important duties have been performed by the officers above named with the most commendable diligence and intelligence, and much of whatever success belongs to the preparation and presentation of the matter collected is due to these officers.

Capt. McClellan, of the corps of engineers, after the completion of his field operations, was directed to visit various railroads, and to collect information of facts established in the construction and working of existing roads, to serve as data in determining the practicability of constructing and working roads over the several routes explored. The results of his inquiries will be found in a very valuable memoir herewith submitted.

Very respectfully, your obedient servant,
JEFF'N DAVIS, *Secretary of War.*

Hon. LINN BOYD,
Speaker of the House of Representatives.

A.

Table showing the lengths, sums of ascents and descents, equated lengths, cost, &c., of the several routes explored for a railroad from the Mississippi to the Pacific. (For the grades, see the profiles accompanying the report.)

	Distance in straight line.	Distance by proposed railroad route.	Sum of ascents and descents.	Length of level route of equal working expense.	Comparative cost of different routes.	Number of miles of route through arable land.	Sterile region. No. miles of route through lands generally unarable, arable soil being found in small areas.	Sterile region. No. of square miles of some of areas of largest bodies of arable land in uncultivable region.	No. of miles at an elevation above 0, and less than 1,000 feet.	No. of miles at an elevation greater than 1,000 and less than 2,000 feet.	2,000 and 3,000.	3,000 and 4,000.	4,000 and 5,000.	5,000 and 6,000.	6,000 and 7,000.	7,000 and 8,000.	8,000 and 9,000.	9,000 and 10,000.	Summit of the highest pass on the route.	
	Miles.	*Miles*	*Feet*	*Miles*															*Feet.*	
Route near 47th and 49th parallels, from St. Paul to Vancouver.	1,445	1,864	18,100	2,207	*$130,781,000	374	1,490	‖1,000	470	580	720	130	97	28	...	...	...	...	6,044	Tunnel at elevat'n of 5,219 feet.
Extension thence to Seattle	......	161	1,000	180	*10,020,000	161	....	....	161											
Route near the 41st and 42d parallels, via South Pass from Council Bluffs to Benicia.	1,410	2,032	29,120	2,583	116,095,000	632	1,400	‖1,100	168	170	210	160	580	254	370	107	20	...	8,373	
† Route near the 38th and 39th parallels, from Westport to San Francisco by the Coo-che-to-pa and Tah-ee-chay-pah Passes.	1,740	2,080	49,986	3,125	Cost so great that the road is impracticable.	620	1,460	‖1,100	340	276	165	348	496	170	60	155	80	20	10,032	Tunnel at elevat'n of 9,540 feet.
The same, from Westport to San Francisco by the Coo-che-to-pa and Madelin Passes.	1,740	2,290	56,514	3,360	.....do.....	670	1,620	1,100	275	209	190	142	725	281	110	155	80	20	10,032	Tunnel at elevat'n of 9,540 feet.
Route near the 35th parallel, from Fort Smith to San Pedro.	1,360	1,892	48,812	2,816	‡169,210,265	416	1,476	2,300	305	347	260	185	160	305	235	95	.....		7,472	
Branch road to San Francisco, from the Mohave river.	......	406	7,500	506	19,935,000	322	84	....	290	10	72	35								
Route near the 32d parallel, from Fulton to San Pedro.	1,400	1,618	32,784	2,239	68,970,000	408	1,210	2,300	485	300	100	170	503	60	...	...	...	...	5,717	
Extension to San Francisco	......	446	10,150	632	25,100,000	376	70	....	290	30	65	25								

* These are the estimates of the office, those of Gov. Stevens having been brought to the same standard of increased cost as the other routes, and his equipment reduced to that of the other routes. His estimates were $117,121,000 and $7,030,000.

† Supposing the route to be a straight line, with uniform descent from the Un-kuk-oo-ap mountains (near Sevier river) to the entrance of the Tah-ee-chay-pah Pass, the most favorable supposition.

‡ This estimate for the route near the 35th parallel is thought to be largely in excess.

‖ These sums do not include the areas of cultivable soil as far west as the Cascade and Sierra Nevada mountains.

The sum of the minor undulations (not included in the sum of ascents and descents here given) will probably be greater for the route of the 47th parallel than for the other routes; that for the route near the 32d parallel will probably be the least of all.

With the amount of work estimated for the roads in this report, the equated lengths corresponding to the sum of ascents and descents has but little practical value. With a full equipment and heavy freight business, the sum of ascents and descents becomes important. A comparison of the degree of curvature of the routes cannot be made.

NOTE TO TABLE A.

The sum of the ascents and descents given for the various routes, does not take into consideration those minor undulations which sometimes largely increase the aggregate.

I think it probable that when detailed surveys are made, it will be found that this sum for the route near the 47th parallel will be more increased than those for the other routes, and that the sum for the route near the 32d parallel will be less increased than the others.

The equated lengths corresponding to these sums, may give erroneous impressions. If the loads to be habitually carried over the roads are within the power of the engines over the greatest grades proposed, then the sums of ascents and descents really have little meaning or value. The wear and tear of rail and machinery, and consumption of fuel, would be somewhat greater on the road having the largest sum; but the difference would not be worth taking into account, unless there was an equality in all other respects between the routes.

If there are some grades so steep as to require the division of the loads habitually carried over other portions, the cost of the extra locomotives, and of working them over those portions, will show the extent of the disadvantage and yearly cost.

So far as any estimate has been made by me of the amount of work to be done on the roads, these sums of ascents and descents have little practical value, since those portions of the routes have been indicated where it may be considered advisable to use steep natural slopes with extra engines, to expedite the completion of the road, and save expensive road-bed preparation. With a full equipment and heavy freight business, the sum of ascents and descents becomes important.

The nature of the surveys does not admit of a comparison of the degree of curvature on the several routes.

B.

Distances of the eastern termini of the several Pacific railroad routes to the Mississippi river, Boston, New York, Charleston, and New Orleans, by railroads built, building, and projected, as measured on the "Railroad Maps."

	Miles.
1. St. Paul to Boston	1,316
to New York	1,190
to Charleston	1,193
to New Orleans	1,198
Aggregate	4,897
2. Council Bluffs to Rock Island, (Miss. river)	267
to Boston	1,374
to New York	1,252
to Charleston	1,195
to New Orleans	1,075
Aggregate.	5,163
3. Westport, mouth of Kansas, (near Fort Leavenworth,) to St. Louis, (Miss. river)	245
to Boston	1,415
to New York	1,220
to Charleston	1,045
to New Orleans	875
Aggregate	4,800
4. Fort Smith, on the Arkansas, to Memphis, (Miss. river)	270
to Boston	1,540
to New York	1,345
to Charleston	960
to New Orleans	655
Aggregate	4,770
5. Fulton to Gaines, (Miss. river)	150
to Boston	1,530
to New York	1,335
to Charleston	950
to New Orleans	402
Aggregate	4,367

LIST OF DOCUMENTS ACCOMPANYING THE REPORT OF THE SECRETARY OF WAR.

I.—Examination by Captain A. A. Humphreys, Topographical Engineers, of the reports of the explorations to determine the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean.

II.—Memoranda by Captain George B. McClellan, Corps of Engineers, upon some practical points connected with the construction and working of railways.

III.—Letter of Major General Jesup, Quartermaster General U. S. A., upon the cost of transporting troops and supplies to California, Oregon, New Mexico, &c.

IV.—Report of Governor I. I. Stevens upon the route near the 47th parallel.

V.—Reports of Lieutenant E. G. Beckwith, 3d Regiment of Artillery, upon the routes near the 41st and 38th parallels.

VI.—Report of Lieutenant A. W. Whipple, Topographical Engineers, upon the route near the 35th parallel.

VII.—Report of Captain John Pope, Topographical Engineers, upon that portion of the route near the 32d parallel from Preston to the Rio Grande.

VIII.—Report of Lieutenant John G. Parke, Topographical Engineers, upon that portion of the route near the 32d parallel from the Rio Grande to the Gila

IX.—Extract from the report of Major W. H. Emory, Topographical Engineers, of a military reconnaissance made in 1846 and 1847.

X.—Report of Lieutenant R. S. Williamson, Topographical Engineers, of explorations in California in connexion with the routes near the 35th and 32d parallels.

AN EXAMINATION

BY DIRECTION OF THE

HON. JEFFERSON DAVIS, SECRETARY OF WAR,

OF THE

REPORTS OF EXPLORATIONS FOR RAILROAD ROUTES

FROM

THE MISSISSIPPI TO THE PACIFIC, MADE UNDER THE ORDERS OF THE WAR DEPARTMENT IN 1853-'54, AND OF THE EXPLORATIONS MADE PREVIOUS TO THAT TIME, WHICH HAVE A BEARING UPON THE SUBJECT:

BY

CAPT. A. A. HUMPHREYS & LIEUT. G. K. WARREN,

CORPS TOPOGRAPHICAL ENGINEERS.

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AN EXAMINATION

OF THE

REPORTS AND EXPLORATIONS FOR RAILROAD ROUTES FROM THE MISSISSIPPI TO THE PACIFIC.

WAR DEPARTMENT,
Office of Pacific Railroad Surveys, Washington, February 5, 1855.

SIR: In accordance with your instructions, I submit the following result of the examination of the reports of the explorations, made under the orders of the War Department, to determine the most practicable and economical route for a railroad from the Mississippi to the Pacific; as well as of the explorations and surveys previously made which have a bearing upon this subject.

It has been found impossible to complete the general map of the country embracing these and former explorations, owing to the great amount of labor required in its preparation, the unfinished condition of the original maps and other data upon which it is to be founded; and the heavy duties imposed upon the officer having it in charge.

This map should be accompanied by a report giving the authorities and data upon which it rests, with explanations of the adjustment of discrepant authorities; and also a brief memoir upon the physical geography of the regions embraced within its limits. Such a memoir necessarily formed a preliminary to a report upon the most practicable and economical route for a railroad from the Mississippi to the Pacific; but the unfinished condition of the maps and material collected in the departments of science necessary to elucidate the subject, and the insufficiency of the material, when prepared, for so comprehensive a subject, precluded the possibility of its being undertaken at the present time, more especially as the labors of all in the office were required in the preparation of the details necessary to discuss the greater or less degree of practicability and economy of each route separately.

The report herewith submitted partakes more of the character of memoranda upon the different routes, than of a report upon the whole subject; and, in fact, it was prepared as such, with the intention, principally, of aiding your examination of the reports of the officers charged with the explorations, rather than as a general report upon all the routes. These memoranda would have served as the basis of a general report, but time does not admit of their being placed in that shape, and they are consequently submitted in their present condition, with this explanation of the cause of their deficiency in comprehensiveness of matter, and in arrangement.

Upon relieving Major Emory, in August last, from the charge of the Pacific Railroad office, I found that the preparation of the material for the general map, a work of great labor, and the superintendence of its construction and drawing, had been intrusted to Lieut. G. K. Warren, topographical engineers, whose zeal and ability in the performance of this and the general office duty, Major Emory acknowledged in warm terms. Lieut. Warren has continued in charge of the office duties, which include the critical examination of the reports, maps, profiles, and all original data submitted by the exploring parties and others, and reports upon the result; the preparation of the general map and its engraving; the compilation of profiles of all the routes recently explored and previously examined barometrically; the preparation of all the maps, profiles, and other drawings made in the office, comprising the duplication of the originals received from the exploring parties; the preparation of reports upon those routes and portions of routes and lines formerly explored, but not with a special view to the railroad question. In addition to this, he has likewise largely aided me in making this report.

This laborious service has been executed by him with great intelligence, zeal, and energy.

Lieut. H. L. Abbot, topographical engineers, was assigned to duty in this office in October last, and has most zealously aided Lieut. Warren in the compilation of the office profiles, and assisted me in investigations connected with this report.

I would especially call your attention to the admirable arrangement of the profiles which have been compiled in the office, by Lieuts. Warren and Abbot, exhibiting so well all the information upon, and the data and statistics of the routes, (as far as it is possible to compress them into so small a space,) as to serve the purpose of a brief report.

In making this examination I have had the advantage of frequent personal conferences with the chiefs of the exploring parties, and with Dr. John Evans and W. P. Blake, esq., geologists.

I have also availed myself of the information contained in the memoranda upon various practical points connected with the construction and working of railroads; prepared in the office by Bvt. Capt. George B. McClellan, corps of engineers, as suggested by my letter to the department of the 7th October last.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,
Captain Topographical Engineers.

Hon. Jefferson Davis,
Secretary of War.

CHAPTER I.

ROUTE NEAR THE FORTY-SEVENTH AND FORTY-NINTH PARALLELS OF NORTH LATITUDE.

Although the report of Governor I. I. Stevens of his exploration of the northern route is clearly and forcibly written, yet, as all the facts bearing upon a particular portion of the route are not always to be found in one place, I have thought that it would facilitate the review to recapitulate the leading characteristics of the railroad route proposed, with such additional investigations and opinions as appeared to be necessary. The great extent of ground examined, the number of subjects treated, and the voluminous character of the report, seemed to require this somewhat laborious process.

The general direction and position of the extreme northern route is mainly determined by the following considerations:

1. From the great northern bend of the Missouri, (lat. 48° 30′, about,) near the mouth of White-earth river, to Council Bluffs, (lat. 43° 30′,) the river flows in a general southeast direction. Throughout this portion of its course the country on either side is generally rough and broken; to the east lies the Coteau du Missouri, a high, rolling prairie, and to the west a rough and rugged country (including the "Mauvaises Terres," and excepting the smooth table-land divide between the Yellow Stone and Missouri) extends to the base of the mountains. To the east and north, the Coteau du Missouri sinks into the prairie, and near the parallel of 49° can be completely turned. The northern route should, therefore, seek the shortest practicable line between this point and the navigable waters of the Mississippi. St. Paul, at the head of navigation of the Mississippi, appears the most suitable eastern terminus of the road. The manner in which these two points are connected will be discussed hereafter.

2. After passing the Coteau du Missouri, the valley of the Missouri and its tributaries, in direction and acclivity, furnish the best approach to the Rocky mountains, the passes of which, near the sources of the Missouri, in latitude 47°, have an elevation of about 6,000 feet, being nearly 1,500 feet lower than the Great South Pass.

3. The Rocky mountains once crossed, the route to the Pacific is then determined by the course of the tributaries of the Columbia.

Finally, the navigable character of the Missouri, of the Columbia, and of the great lakes, as well as the Mississippi—all of which can be made to aid in the construction of this road—gives to it, at first glance, a character of great importance. Its objectionable features are also apparent in its high northern latitude, and consequent severity of climate, which greatly detracts from the importance of the aid from navigation by obstructing the rivers with ice, and in the long intervals through which labor in the open air must be suspended, and, finally, in its contiguity to the soil of a powerful foreign sovereignty.

The northern railroad route may be said to commence at St. Paul, in about latitude 45°, at the head of steamboat navigation of the Mississippi. The road ascends the left bank of the Mississippi, passing over fertile prairies or oak uplands to Little Falls, the best point for crossing the river, a distance of 109 miles, without rock-cutting, and with light grades, seldom exceeding ten feet per mile. For structures, both of wood and stone, the material is good, and near at hand.

Crossing the Mississippi river with 325 feet of bridge, the line is directed to the prairie of the Bois des Sioux, an extensive flat plain. Between this and the Mississippi is a high, rolling prairie, forming part of the divide between the waters of Hudson's bay and those of the Mississippi. The road passes successively through a wooded and fertile prairie country, and crosses the tributaries of the Minnesota river at their sources. From the Mississippi to the Bois des Sioux the distance is 110 miles; the rise is about 750 feet; the grades generally ten feet per mile, though occasionally thirty feet. Lumber and stone are to be supplied from the Mississippi and west of it; the excavation and embankments are light.

The line passes for 40 miles over the almost absolute plain of the Bois des Sioux, leaving its western edge near and north of Dead Colt Hillock, here entering the rolling prairie, keeping south of the Shayenne river, whose valley is 150 to 200 feet below the general level of the prairie, and along the dividing ridge between it and the Rivière à Jacques; then crossing the latter river at a width of 120 feet, it is directed towards the valley of Mouse river, bounded on the south by the high plateau of the Coteau du Missouri. Keeping along the base of the coteau, to avoid the deep coulées of Mouse river,* and its tributary, Rivière des Lacs, the coteau is turned, near the head of the latter river, by the Grande Coulée, and with a grade not exceeding 40 feet per mile, the line passes to the bottom lands of the Missouri, near the mouth of Big Muddy river, about 30 miles west of Fort Union. Steamboats of two-feet draught can at all times, when not obstructed by ice, ascend the Missouri to Fort Union, the trip up from St. Louis occupying 42 days, and back 17 days. The total rise in this distance (about 400 miles) from the prairie of the Bois des Sioux to the Missouri is 700 feet. From Dead Colt Hillock to the valley of Mouse river, 200 miles, the country is in part undulating, rising gradually.

The earth-work from the Mississippi to the Missouri will be neither heavy nor expensive, and no rock excavation, except in crossing the "divide into the valley of the Missouri. The grades need not exceed 30 feet per mile, and will rarely be so great."

For 400 miles of this portion of the route, wood for building and fuel (if wood be used for it) must be obtained from the Red River of the North, and from the bottom lands of Mouse river. But little stone for masonry is needed. Excellent sandstone can be obtained in the vicinity of the Butte de Maison du Chien, near which the line enters the valley of Mouse river. Materials for good bricks are to be obtained on Red, Bois des Sioux, Shayenne, and Mouse rivers. From Camp Guthrie, on the Shayenne, to the Mouse River valley, (about 150 miles,) nearly one-half the small ponds and lakes are brackish and salt. The fresh-water ponds are, however, constantly interspersed and more abundant, and "occur quite as often as is desirable either for travelling or railroad purposes. With this abundant supply, no unusual construction or expense will be required in establishing watering places."—Governor Stevens's report.

Mr. Lander, the estimating engineer, says, "the portion extending through the salt-water region—the one under consideration—will need particular attention regarding a supply of pure water for the use of engines. The proper mode of overcoming this difficulty will be by extending an aqueduct along the line of the road from the lakes upon the Grand Coteau du Missouri." An estimate for this purpose is made, and, including the cost of planting 640 acres of trees every 20 miles over — miles of the route, amounts to $2,000,000.

Should supplies of water be needed at points where it could not be furnished by the usual means, because of the small quantity of rain that falls, artesian wells might prove more economical, if the geological formations indicate their feasibility.

The position of the northern part of the Grande Coulée, by which the route leaves the valley of Rivière des Lacs and enters that of the Missouri, has been determined from an estimated distance of twenty miles from the odometer line. As represented upon the map, it approaches so close to the 49th parallel (about two miles from it) that, without more accurate determination, it cannot be known whether the route, as here projected, may not pass over British territory.

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* Mouse river, next to the Red River of the North, is the most important river on the route between the Mississippi and Missouri. It flows in a deep, wide valley 200 feet below the prairie-level, with a wooded bottom from one-half to two miles wide, its high and steep banks being cut by deep coulées extending ten and fifteen miles into the prairie.

After reaching the Missouri, the line follows the valley of this stream to the mouth of Milk river, 120 miles from Fort Union, then ascends the valley of Milk river, 187 miles, the grades rarely exceeding the river-slopes, (the Missouri being one foot per mile, the Milk three feet per mile,) with an average embankment of eight feet, and with but little rock excavation, and that in soft sandstone. The river bottoms, composed of clay and sand, are soft and sloppy in wet weather, and parched and cracked during the dry season. As the Rocky mountains are approached, the country bordering the Missouri river is rough and broken; nearer the mountains, prairies afford more favorable ground for location.

Having turned the Bear's Paw mountains, lying between the Milk and Missouri rivers, the line leaves the valley of Milk river and rises to the prairie, with a grade of thirty-five feet per mile, taking a southwest direction towards the passes in the Rocky mountains, which lie near the 47th parallel of latitude, crossing in its course the Maria's and Teton rivers with grades of forty feet per mile, and the Sun river without difficulty, the whole distance being about 440 miles.

The cotton-wood of the Missouri and Milk rivers not being suitable for building material, except for a temporary road, by which to build the permanent one, this portion of the route is dependent upon the pine of the Trois Buttes mountain, (sleepers for 300 miles single track from this source,) of the Rocky mountains, and of the mountains south of Fort Benton. Good sandstone is to be found near Fort Union, at the crossing of Milk river, and at the Trois Buttes; lime near Fort Union, the Trois Buttes, and the Rocky mountains; clay, for brick, on the Missouri and Milk rivers; and sand in the beds of the rivers, though not abundant, in a clean state.

If cotton-wood cannot be used as fuel, we have on this route spaces of 100, 200, and 400, or 500 miles between the points of supply; that is, 200 miles from the Red river supply to that of the Mouse river; 400 miles from the Mouse river supply to that of the Bear's Paw, or 500 to that of the Trois Buttes; and from the Trois Buttes to the Rocky mountain supply, not less than 100 miles. The supplies of lumber are the same as for fuel.

At what distances apart large supplies of water can be had from the Red River of the North to Maria's river is not stated. The rivers along which the road runs cannot always be relied upon for it, since the road is immediately under the bluffs of the valley, and the small streams are dry in summer, and so of the ponds on the prairies; both in extreme dry and hot seasons, and in the winter, there would be deficiencies. The high plateaux making back from these rivers, it is thought, will afford the means of securing, by reservoirs, ample supplies. The precise data upon which this opinion is formed are not given; the number, capacity, and position of the ponds or small lakes proposed to be used are not stated, nor the distances at which the reservoirs can be made.

Between the Maria's and Sun rivers, Grizzly Bear lake is indicated as a point of supply. From the Bois des Sioux to Rivière à Jacques is about 120 miles. From Rivière à Jacques to Butte de Maison, where probably the ponds of the Coteau du Missouri could give a large supply of water, is 115 miles. Thence to head of Rivière des Lacs, 120 miles. Thence to mouth of Big Muddy, on the Missouri, 120, &c. There can be no doubt that supplies of water at these distances can be got during all seasons, which may be made to answer for railroad purposes, though not sufficient for working parties.

The line has now reached the base of the Rocky mountains, and an elevation, where it may enter the passes through them, of 4,700 feet above the sea.

In deciding upon the route by which the road should cross this mountain chain, regard must be had, not only to the difficulties of approach to the passes and the difficulties in the passes, but also to the best pass (from every consideration) of the Bitter Root mountains.

This last is a secondary mountain chain lying west of the principal, separating from it in about latitude 45° 30′, and running northward and westward into the British possessions. Flowing in the valley, between these two chains, are the Flathead and St. Mary's or Bitter

Root rivers; the former rising in about latitude 48° 30′, and running south, and the latter rising in about latitude 45° 30′, and running north. As these two streams approach each other a spur from the Rocky mountains turns them towards the west. Their junction forms Clark's fork of the Columbia, a clear, rapid river, from 150 to 200 yards wide, rarely fordable, which has forced a passage through the Bitter Root mountains; this pass was adopted for the railroad route.

Seven passes in the Rocky mountains were examined; they lie between latitude 48° 30′ and latitude 45° 30′.

Beginning at the north, in about latitude 48° 30′, is the Maria's Pass, leading from the Maria's river to the Flathead river. It is not desirable in direction, unless a route leading westward be found north of Clark's fork. The tunnel, at its summit, would be at an elevation of 8,000 or 8,500 feet; about the limit of perpetual snow in that latitude. On the west, the fall in seventeen miles would be 2,170 feet. The great severity of the climate would of itself render this pass almost impracticable. About the 20th of October, Mr. Tinkham found the snow-banks of the previous winter still lying upon the shaded borders of the small lakes or ponds on the eastern slopes at an elevation of about 5,600 feet. The instruments used by Mr. Tinkham were a barometer and pocket-compass.

The next pass is that of Lewis and Clark, connecting the head-waters of Dearborn and Blackfoot rivers—the former a tributary of the Missouri, the latter of the St. Mary's. The summit ridge has an elevation of 6,323 feet, which must be pierced by a tunnel two and a half miles long, through rock, at an elevation of 5,300 feet; grades of approach from the east forty feet to the mile, and of descent to the valley of Blackfoot river, "it is believed," will not exceed fifty feet per mile.

The examination of this pass was made by Mr. Lander; his instruments were a barometer and pocket-compass. He abandoned the examination (the reasons for it are not, to my apprehension, contained in the extracts from his report) seven and a half miles west of the summit, and four and a half miles before reaching the route of the main party that entered the valley of Blackfoot river by Cadotte's Pass. The connexion of Lewis and Clark's Pass with the valley of the Blackfoot river has not, then, been made, though "believed practicable at grades not exceeding fifty feet per mile." This pass should be gone over instrumentally before its practicability can be considered demonstrated. It has been adopted in the railroad estimate, and is probably practicable.

The next pass is Cadotte's, connecting a tributary of Dearborn river with a tributary of the Blackfoot river. The approach to this pass is practicable, though difficult, owing to the numerous deep ravines of the tributaries of Beaver creek, a northern branch of Dearborn river, over which the road must cross in approaching the pass from Sun river. The summit of the pass has an elevation of 6,044 feet; will require a tunnel 4½ miles long (fifty per cent. of cutting in clay slate,) at an elevation of 5,000 feet, with grades of sixty feet approaching from the east, and forty feet per mile from the west. The pass itself is difficult.

The main train of the exploring party passed over this route, the instruments used being a barometer, odometer, and Schmalkalder compass. It follows the valley of Blackfoot river, generally narrow and wooded, to its junction with the Hell-Gate, a distance from the summit of ninety-three miles. For twenty miles before this junction there is a narrow gorge ending in Hell-Gate. From the narrowness of the valley and winding of the stream, it will be necessary to cross frequently from side to side, and the bridging will be expensive from the absence of stone suitable for building material, the nearest point of supply known being in Flathead River valley, seventy miles distant from Hell-Gate. The grades will vary from thirty-five to forty-five feet per mile.

The Blackfoot river joins the Hell-Gate river just before the latter makes the passage of the gorge from which it derives its name, the Hell-Gate river itself being a tributary of the St. Mary's. At the head of the *Little* Blackfoot (another tributary of the Hell-Gate, coming from the east,) two passes in the Rocky mountains, in latitude 46° 30′, were explored. They are sometimes called the Northern and Southern *Little* Blackfoot Passes, but named in Governor Stevens's map as the Hell-Gate Passes. They connect between the waters of the Little Blackfoot and Prickly-Pear creeks.

South of these, in latitude 45° 45′, another pass was examined, called the Hell-Gate Pass. It connects the south fork of Hell-Gate with a branch of Wisdom river. And still further south, in latitude 45° 38′, another pass, called the Big Hole Mountain or St. Mary's Pass, was explored, connecting the waters of St. Mary's river with a fork of Wisdom river. These last four passes are all reported as probably practicable; but as the southern *Little* Blackfoot, Hell-Gate, and St. Mary's Passes received no instrumental examination, as the last-named is out of direction, and the two former involve a considerable detour from the route of the Missouri, are approached with difficulty, and will only become important should a good route or routes be found through the Black Hills to the Mississippi, it is unnecessary to note them further. The profiles of the northern *Little* Blackfoot with its approaches from the Missouri, of the valleys of the *Little* Blackfoot and of part of the Hell-Gate river, were determined by Mr. Tinkham, his instruments consisting of a barometer and pocket-compass.

The approach by this route is over a broken region of country, and a better approach, it is thought, will be found north of the Missouri, nearer the base of the mountains, along the line examined by Lieutenant Mullan. The elevation of the summit is 6,250 feet; a tunnel of two miles will be required. The eastern approach is estimated practicable with grades of fifty or sixty feet per mile, and the western descent with a grade of thirty feet to the mile. A thorough examination of this route is recommended in connexion with the other passes in this vicinity. It is unnecessary, therefore, to consider it further, since the data are still too imperfect to enable us to form certain conclusions.

Three passes through the Bitter Root mountains were explored; a fourth was subsequently examined, but has not yet been reported upon; a fifth pass, the northern Nez Percés, it was not considered necessary to examine.

The passes reported upon are that of Clark's fork, which has been adopted as being the least difficult; the Cœur d'Alene Pass, by the Cœur d'Alene Mission, and the southern Nez Percés trail. Beginning at the south, the southern Nez Percés trail, leading from the head of St. Mary's river to the head of a tributary of the Snake river, (the southern fork of the Columbia) was examined by Mr. Tinkham, in the latter part of November and first half of December; his instruments were a barometer and pocket-compass until the former was cached. From the great height of the summit, 8,000 feet, and the great depth of snow so early in the season, it is not necessary to consider this pass. It is probably impracticable.

The northern Nez Percés trail is reported to be of the same character.

The Cœur d'Alene Pass, leading from the Bitter Root near its junction with the Flathead to the Spokane river, if found to be practicable, would give a route to Wallah-Wallah seventy miles shorter than that by Clark's fork; but as no instruments for measuring vertical or horizontal distances were carried with the party that examined this route, its practicability cannot be considered established, but merely such information gained as serves to show that it is probably practicable, and that an instrumental profile should be taken.

The pass of Clark's fork formed by the passage of the river through the Bitter Root mountains, along which the main party travelled, is practicable.

It will be noticed that the passes of Lewis and Clark, and Cadotte, give the most direct route from the line east of the Rocky mountains to this pass.

We will now return to the line of the main party at Hell-Gate, the termination of the Blackfoot valley. From this point two lines were examined to Clark's fork. One follows the valley of the Bitter Root to Clark's fork; the other crosses a dividing ridge to the valley of Jocko river, keeping along this stream to its junction with the Flathead, which it then follows to Clark's fork.

Of the first, Governor Stevens says: "The route will be long, in consequence of the curves of the river, and will involve curves of the minimum radius, numerous bridge-crossings, considerable side-cutting, and high embankments on the prairie portions, in consequence of the spring freshets (twenty to thirty feet vertical rise.) The rock, in side-cuttings, can be easily quarried. The greater portion of this route has been personally examined by me, and I am satisfied of its practicability, though at great expense."

Mr. Lander, in whose judgment and experience Governor Stevens placed great confidence, says of this portion of the route: "The descent of the Bitter Root is very severe. The general grade of the river-valley for that distance is not great ($11\frac{1}{10}$ feet per mile,) but the changes in level are abrupt, the valley extremely narrow and crooked; sharp curvature and steep gradients will be needed under any system of location, and, by the best mode of conquering these difficulties, the line will be extreme in cost and nearly impracticable."

The only instrument used on this examination was a pocket-compass. Governor Stevens's party left the Bitter Root at the debouche of the Cœur d'Alene Pass, and Mr. Lander at a point several miles before reaching Clark's fork. The topographer of the expedition, Mr. Lambert, describes this unexamined portion of the Bitter Root as a cañon, but in conversation I find that his description was inferred from partial information, and was not intended to mean that the mountain-sides closing in upon the river were vertical walls. Dr. Suckley makes no special mention of it. In respect to this portion of the route, he says: "The numerous very short curves, obliging frequent crossings by strong bridges, the great length of the route if the river is followed, the steep banks, and the high-raised work necessary to prevent the encroachments of the freshets, (which in many places rise from twenty to thirty feet above the common level,) will all render this part of the road exceedingly expensive." In view of the difficulties to be encountered on this line, and of the nature of the reconnaissance of it, it should not be considered practicable until more exact data are obtained upon which to form a correct opinion.

By the second line to Clark's fork: To overcome the summit of the Jocko divide, 852 feet above Hell-Gate, the approach will require a grade of sixty feet, and the descent to the valley of the Jocko a grade of sixty feet, both for short distances, with heavy embankments, and probably a lofty bridge. Lieutenant Donelson is of opinion that these grades may be reduced to forty-five and forty feet. Along the valley of the Jocko and Flathead rivers, on their left banks to Clark's fork, the grade will be twenty feet per mile. Ten or twelve miles before reaching Clark's fork, the mountains close in upon the river with steep slopes and rough projecting rocks. The heavy growth of timber obliged the party to leave the river, returning to it again at Horse Plain on Clark's fork, a few miles below the junction of the Bitter Root and Flathead. This portion of the Flathead, like that of the Bitter Root, is described by Mr. Lambert as a cañon. The distance to Horse Plain from Hell-Gate by the Jocko is 70 miles, by the Bitter Root 95 miles.

A better connection with the Flathead can probably be made by leaving the Blackfoot valley above the defile; further examination is necessary to establish this, however.

Lieutenant Donelson says the average fall of Clark's fork is eleven feet per mile, and he estimates that the railroad could descend with gradients of from fifteen to twenty feet per mile. With the exception of occasional small prairies, marked on the map, its valley throughout is heavily timbered, mainly with pine. At several points on the route the rocky hill-sides crowd upon the river, and all deep-cutting will probably expose the rock, apparently, in general, a species of limestone or trap.

The line crosses the Flathead some miles above its junction with Clark's fork, (or Bitter Root?) continues on the right bank as far as Big Rock; then crosses Clark's fork, following the left bank, and recrosses at the Cabinet mountain. Tunnelling the Cabinet mountain 300 yards through 50 per cent. basaltic rock, it would continue on the right bank of the river to

Lake Pend d'Oreille, and on the western side of the lake to its lower extremity. The river and lake are subject to freshets fifteen feet in height.

The summit separating Clark's fork and Spokane river is about 800 feet above the level at which these two rivers are crossed. The transit could be made, Lieutenant Donelson reports, with gradients not exceeding twenty-five feet per mile, though Governor Stevens says forty feet. The mountain region ends near the crossing of Spokane river. Mr. Lander, in continuation, after reporting upon the Bitter Root, says: "From the junction of the Bitter Root with Clark's fork to the crossing of Clark's fork, below Lake Pend d'Oreille, the line assumes a more favorable character; and, although still severe, may be readily adjusted to reasonable rate of curvature and grade. The crossing of the summit section, between Lake Pend d'Oreille and the valley of the Spokane, is very favorable, and can be made upon gradients of forty feet per mile. All great difficulties of location upon the route cease at the valley of the Spokane."

Regarding the subject of construction west of the Rocky mountain summit, the line passes, in nearly its whole extent, through forests which could furnish an abundance of pine and cedar of fine quality, and of fir and larch. The rafting of lumber cannot be carried on above Horse Plain, though it is probable that logs can be run in the freshets from the heads of the tributaries of Clark's fork. Lieutenant Donelson saw no good stone for building over this space. A locality on the Blackfoot, not far from Hell-Gate, another at Big Rock, (on Clark's fork,) and the mountains on the right of Clark's fork, for some distance below Thompson's prairie, would furnish stone in great abundance, which would answer for ordinary purposes. Mr. Tinkham states that not far from the Hudson Bay Company's post, among the Flatheads, good limestone for building could be obtained. Good granite is found on the Columbia, 140 miles above the mouth of the Yakima. Dr. Evans, geologist, informs me that stone will be found throughout this section at distances sufficiently near to obviate excessive cost. Sand can be obtained from Clark's fork, Pend d'Oreille lake, and elsewhere. The earth excavation and embankment throughout this section (from the east base of the Rocky mountains to the Spokane river) will be large in amount, and expensive. In all the mountain valleys the deep side-hill cuttings will frequently expose rock, and the bulk of the rock excavation in the entire railroad route will be in this section.

It is evident that throughout this section, from the entrance of the Rocky Mountain Pass to the crossing of the Spokane, a distance of 365 miles, the difficulties of construction will be very great; and that even if the two extremities rested upon thickly inhabited districts, the cost would be excessive.

Upon the passes of the Rocky mountains, Governor Stevens says:

"It is not doubted there are other passes in this portion of the Rocky mountain range, even better than those explored; they are indicated by the general depression of the mountain range, with the greater frequency of the streams stretching out to meet each other from the opposite slopes of the mountains; and I consider it important that, in future operations, a whole season should be devoted to their thorough examination, and that instrumental surveys should be made of the pass found to be the most practicable."

The region between the Cœur d'Alene mountains and the Cascade range, a space of 200 miles, is called the Great Plain of Columbia, or the Spokane Plain. It is a table-land, whose central and western portions are of trap formation, and are described on the map as sandy, rocky, and sterile. Its summit, some 800 feet above the level of the crossing of the Spokane, could probably be attained with gradients of 35 feet, the descent to the crossing of the Columbia river (near the junction of the Snake river) with grades of 30 feet, and from thence to Wallah-Wallah, 10 miles further, with grades of 20 feet. From the crossing of the Spokane to the crossing of the Columbia it is about 140 miles, 110 of which are over the treeless plain of the Columbia. The river is here from 400 to 450 yards wide, with good approaches. The earth excavation and embankment will not probably exceed the heaviest work of the prairies east of the mountains. A portion of the excavation on the first part of the Spokane Plain will be rock (basaltic trap.) Its eastern end rests upon the pine, cedar, and larch districts of the Columbia.

Lumber can be brought down the Columbia to its western end, and also from the Yakima, 100 miles above its mouth. Good granite is found on the Columbia, 140 miles above the mouth of the Yakima.

Within our territory, nearly the whole space between the Columbia river (its general course being from north to south) and Puget sound, is occupied by the Cascade mountains, with their secondary chains, spurs, and high, broken table-lands. Through these mountain masses, between the parallels of 45° 30′ and 49° north latitude, there are but two passes reported practicable for a railroad—that of the Columbia river, and that in which the north or main fork of the Yakima (a tributary of the Columbia) heads. This latter pass has been heretofore erroneously called Snoqualme Pass. The Yakima Pass gives the most direct route to Puget sound, the distance by it being 150 or 160 miles shorter than by the Columbia River Pass. The approach to it is by the valley of the Yakima. From the crossing of the Columbia to the commencement of the pine timber, 96 miles, the valley is wide, open, and terraced; the ground is sand, gravel, or loose stones. For 21 miles further, an open pine wood extends, with a light soil, sometimes gravelly. The grades are from 8 to 12½ feet per mile. No difficulties of construction whatever are met with. From this point there are two methods of passing the dividing ridge—one by a tunnel 4,000 yards long, 3,000 feet above the sea; the second by a tunnel of 11,840 yards, 2,400 feet above the sea. For the short tunnel the ascent of 895 feet is made in 18½ miles, giving a grade, supposing it to be uniform, of 48.4 feet per mile, in fifty per cent. rock-cutting. The tunnel 4,000 yards long will pass through solid rock, (silicious conglomerate;) thence to the falls of the Snoqualme, 45 miles from the tunnel, the road will be in side-cutting, (silicious conglomerate) with a grade of 59.8 feet per mile, supposing it to be uniform. The distance to the falls of Snoqualme was travelled over and estimated to be greater by Mr. Tinkham, and the grade proportionately less. From the Snoqualme falls to Seattle, on Puget sound, it is about 30 miles; the first ten will require a grade of not more than 20 feet per mile, and the remaining 20 miles will pass over a level country. If the second tunnel be used, the 18½ miles before reaching it will be with a grade of 15.2 feet per mile, with little side-cutting, through a thickly timbered country. The divide must be pierced by a tunnel 11,840 yards long, of a similar character to the short tunnel; the grade to the Snoqualme falls will then be 46.3 feet per mile, and the total length of the section 240 miles.

But the grades in both cases will be necessarily broken, and higher than the estimate in many places.

The elevations of the different points from the Columbia, to a point about three miles west of the summit, were taken with a barometer; the distances were estimated.

In conclusion, Captain McClellan states: "I am of the opinion that the Yakima Pass is barely practicable, and that only at a high cost of time, labor, and money." The depth of snow upon the summit of this pass has been much discussed. Captain McClellan, who made the reconnaissance, says, that he and his party spared no pains in inquiring of the Indians during the summer, fall, and winter, as to the quantity and nature of the snow in the mountains during the winter. We examined (he says) the snow-marks on the trees, (similar, he informs me, to those made by standing water on trees,) in the passes, &c. All the information obtained was consistent; and the resulting conclusion, that in ordinary winters there could not be less than from 20 to 25 feet of snow in the passes.

For the purpose of examining this point, Mr. Tinkham crossed the mountains from Wallah-Wallah to Seattle, by the Yakima Pass, during the month of January, passing the summit on the 21st of January. "For about six miles on the summit the snow was found to be six feet deep, with an occasional depth of seven, as also of four feet." "The whole breadth of snow, over twelve inches deep, was somewhat less than sixty miles in extent. Of this, about forty-five miles were two feet and upwards; about twenty miles were four feet and upwards; and six miles were six feet and upwards. All the snow was light and dry; it was the accumulated snows of the winter to January 21, deposited in successive layers of a few inches to two feet, which have generally lain undisturbed since their fall; and they present little obstruction to removal, in comparison with the compact drifted snows of the Atlantic States."

From the known effect of abrupt mountains, rising from plains, in increasing the precipitation of rain, it is not probable that less rain falls on the main chain of the Cascade mountains than at Puget sound, but rather more.

The mean amount of the winter rain at Steilacoom, on the sound, is 20.6 inches; the amount is nearly the same each winter. The yearly means of the winter rain, in the table of Governor S.'s report, are erroneous, though the mean for the winter of several years is correct.

Snow occupies from ten to twelve times the bulk of an equal quantity of rain. The snow of the Cascade mountains is reported to be very dry and light, and the proportion between it and rain is probably greater than as 12 to 1. Assuming it to be 12, and supposing the precipitation on these mountains, during December, January, and February, to be in the form of snow, we have at the close of February 20.6 feet of snow.

The mean temperatures at Steilacoom, Puget sound, from observations at the military post there for (four) years, are:

November, 46°.2 Fahr.; December, 38°.3 Fahr.; January, 38°.1 Fahr.; February, 40°.7 Fahr.; March, 41°.8 Fahr.; April, 48°.6 Fahr.

Applying the rule that for every 300 feet of elevation there is a decrease of 1° Fahr., we have for the temperatures of an elevation corresponding to that of the summit of the Snoqualme or Yakima Pass—

November, 36°; December, 28°; January, 28°; February, 30°.7; March, 31°.8; April, 38°.6.

But from the barren and broken character of the mountain masses east of the Cascade crest, the abruptness of the eastern slopes of the main chain, and its great general elevation, 8,000 feet above the sea, with bare rocky peaks projecting above this height, the highest reaching an elevation of 15,000 or 16,000 feet, the temperature of the Yakima Pass must be lower than the rule of decrease of temperature for increase of elevation would give when applied to the temperature of Steilacoom. The influence of these causes is shown in the meteorological report of Lieut. Mowry, by which it will be seen that the climate of the Cascade range and the country east of it is very cold. Lieut. Mowry says, page 404, at Chequoss (a pass in the Cascade chain 4,000 feet above the sea,) on the summit of the Cascade range, August 9th, the thermometer indicated a temperature below the freezing-point, and ice formed to the thickness of half an inch. At the same time and place, strawberries were growing in great luxuriance and abundance. The Indians informed him that the snow fell there as early as November, &c., &c.

Of the 8.69 inches of rain that fell during January at Steilacoom, 5.37 inches fell after the 26th; and of the 20.7 inches rain that fell there during the winter (December, January, and February,) but 7.74 inches had fallen at the time Mr. Tinkham crossed the Yakima Pass, (21st January;) that is, but little more than one-third of the whole quantity that fell during the winter. The above investigation is in accordance, then, with the facts as found by Mr. Tinkham; but one-third of the snow had fallen when he crossed.

Lieut. Grover, in crossing from Clark's fork to the Cœur d'Alene prairie, between the 19th and the 22d of February, found 2½ feet of very hard snow for the most part of the way, the elevation being about 2,000 and 2,500 feet. The country here is very dry, according to Lieut. Mowry.

It seems probable, from the foregoing investigation, that not less than 20 feet of snow is usually to be found on the summit of the Yakima Pass at the close of winter—gradually changing to 12 feet, 6 feet, &c., &c. But the question should not be considered settled until further examinations and an instrumental survey of the Yakima Pass are made.

The terminus of the road should be on Puget sound, and, from the report of Capt. McClellan, the harbor of Seattle would appear to be the most favorable on the eastern shore. To return to the crossing of the Columbia river near the mouth of Snake river.

Capt. McClellan states: "With regard to the Columbia river, I am not prepared to speak so much in detail; the last barometer being broken before we reached there on our return, and for other good reasons, I passed down by water. Mr. Lander, however, travelled the greater part of the distance by land; and as his examination corroborates the opinion I formed at the time, I shall content myself with expressing in general terms the nature of that pass." His conclusion is, that "it is not only practicable, but remarkably favorable;" and, in his opinion, it would be desirable that an instrumental survey should be made of the Yakima Pass and the Columbia River Pass, should any more railroad explorations be made on this line. In conversation Capt. McClellan informed me, that the work on the route along the Columbia river, from the Dalles to near Vancouver, 90 miles, would be similar to that of the Hudson River railroad along the mountain region. Mr. Lander says, "the high floods to which the Columbia river is subject, are serious obstacles to obtaining the best location for cheap construction offered by its valley." From observations made at Fort Vancouver, from May 8 to July 20, 1854, the rise of the river during the flood was 10 feet above spring level, and 17 feet above summer level.

Governor Stevens says: "The pass of the Columbia river, examined personally by myself as well as Captain McClellan and Mr. Lander, is remarkably favorable in its grades, which rarely exceed ten feet, in the ease with which debris from the ledges can be worked to form the embankments required to guard against freshets, and the great facility with which wood and stone, both of good quality, can be transported down the Columbia for purposes of construction. The only serious obstacle is Cape Horn mountain, which, to avoid sharp curvature, may require a tunnel seven hundred feet in length. The grades down the Columbia to near the mouth of the Cowlitz, and thence to Olympia, Steilacoom, or Seattle, will be small, the work light, and abundant materials of all kinds will be found for road-beds and superstructure." The ascents and descents are estimated at 300 and 700 feet. On the Columbia the line is, for the most part of the way, located in the bottom lands of the river, and will rarely be forced from them to the rocky bluffs bordering its intervale. Between Wallah-Wallah and the Dalles Mr. Tinkham found it necessary in only two instances to cross the rocky spurs jutting out from the river bluffs.

The bluffy country bordering the Columbia ceases near Cape Horn. From below the Dalles the woods commence, and continue to the head of Cowlitz river.

"The wide and comparatively flat and wooded valley of the Cowlitz connects with plains, sometimes of prairie and sometimes of woodland, extending to Puget sound, and which, although not fully explored, are sufficiently well known to insure the unusually favorable character of the country for the construction of a railway."

The total length from the crossing of the Columbia to Seattle is about 390 miles. The earth excavation will not probably exceed the heaviest work of the prairies east of the mountains, and is estimated not to exceed an average of seven to eight feet. The material for embankment is almost always of a superior character.

The amount of rock-cutting, with the exception of the portion of the line between the Dalles and Cape Horn, will be very small. The rock is generally a basaltic trap.

In reference to the facilities for construction upon Clark's fork and on the Columbia, Governor Stevens says: "By improvements either in the bed of the river, or in the use of locks at several points on the Columbia and Clark's fork, and by the substitution of rail where such improvement is impracticable, it is not doubted that a continuous communication can be established from the mouth of the Columbia to the mouth of the Spokane, and probably to Colville, and from the Pend d'Oreille lake to Horse Plain. Rails will undoubtedly be required at several of the places, and transfer be made from steamer to steamer."

The total length of the route from St. Paul to Seattle, Puget sound, by the Columbia River Pass, is 2,025 miles, or 2,050 if the Bitter Root river is used instead of the Jocko; by the Yakima Pass, 1,870 and 1,845 miles respectively. The distances just given are taken along the line of location for the proposed railroad. They are nearly the same as those travelled, except on the prairies east of the Rocky mountains, and on the Spokane Plain, where the located line is shorter than that travelled over, there being no serious obstacles to the more direct course. The distances given differ from those used by Governor Stevens, owing to a revision which the maps have undergone since his report was written.

SOIL.

In the absence of the geological report of Dr. Evans, whose field duties in Washington and Oregon Territories have detained him there until recently, the information upon the character of the soil upon the route is not as full, detailed, and satisfactory as could be desired. Previous geological examinations, over portions as far west as about longitude 101° or 102°, show that the uncultivable region begins in about the same longitude on this route as in the latitude of the Arkansas.

From the geological information respecting the region between the meridian of 101° and the Spokane Plain imparted recently by Dr. Evans, from the report of Mr. Gibbs upon the section west of the Spokane, and after a close examination of the reports, the following general conclusions have been arrived at respecting the soil of the region traversed by the northern route.

From the Mississippi to the western border of the Plateau of the Bois des Sioux, in about the meridian of 98° west of Greenwich, the soil is fertile; the upper layer being composed of vegetable mould. Here it begins to be mixed with sand and gravel, the proportion of which ingredients increases as you proceed westward. From Fort Union to the foot of the mountains, (15 or 20 miles east of the crest,) the upper covering of sand, clay, and gravel is from one to three feet thick, and lies upon a coarse sandstone. The grass, luxuriant on the vegetable mould, gradually becomes thinner, until on the sterile soil it is very sparse. Immediately under the mountains it improves again—perhaps from the intermingling of limestone debris, and the comparatively greater fall of rain.

On the Coteau du Missouri the ground is rougher, and the grass thinner, than on the prairie; and west and south of the Missouri it is in many places even yet more rough and sterile, the Mauvaises Terres beginning not far from the mouth of L'Eau-qui-court river.

In fact, the tertiary and cretaceous formations extend from about longitude 97° west of Greenwich to the eastern base of the Rocky mountains; the soil being stiff clay and sandstone, alternating with each other. The former are well constituted for fertility; but, under the present meteorological conditions, (the small yearly amount of rain, and the total absence of it at certain seasons,) they are unsuitable for agricultural purposes. They produce luxuriant grasses in the spring, but in the dry season (the summer) the sun withers the grass; parches, bakes, and cracks the clay surface, and not only gives it a sterile aspect, but renders it uncultivable. The sandstone soils are in themselves sterile. It is thought by some that if the annual burning of the prairies were to cease, forests would grow upon the clay soils, a greater amount of rain in the summer be precipitated by them, and that these clay soils would thus become cultivable.

The river-bottoms in part (where the soils of the different strata become mixed,) and the valleys among the mountains, form exceptions to this general condition of sterility. As, for instance, it is Lieut. Donelson's opinion that upon the Missouri the soil is such that the settlements might be continuous upon its banks up to the mouth of L'Eau-qui-court river, longitude 98°; from that point to Fort Union, about one-fourth could be settled. Above Fort Union, Lieut. Grover says: "On the lower portion of the river (between Fort Benton and Fort Union,) there are many quite extensive bottoms well adapted to agricultural purposes. There is a good deal of arable land, also, in the vicinity of Fort Benton, and in the Sun River valley." The proportion of cultivable bottom lands on this section of the river is much less than one-fourth. The Mouse River valley is represented to be fertile, as its growth of ash, elm, and oak indicates. Describing that portion of the route from Fort Union to Fort Benton, Governor Stevens writes, "The bottom lands, both of the Missouri and Milk rivers, are composed of clay and sand, &c."

The space between the Rocky and Cascade mountain chains is principally occupied, between the parallels of 45° and 49° latitude, with mountain masses and the great elevated plain of the Columbia.

From the main Cascade chain the generally sterile soil extends eastward over the dry region until the rain that falls upon the Cœur d'Alene, Bitter Root, and other mountains, begins to be felt; we then have grazing. The soil improves in quality as the mountains are approached, the valleys of which are represented as fertile, perhaps influenced in some degree by the nature of the mountain debris that have been washed upon them. The Columbia river and its affluents, in their lower courses within the limits above mentioned, are stated to carry gravel and sand, but no fertilizing matter.

It is their upper or mountain valleys (between the Cascade and Rocky mountains) only that are productive; their lower are uncultivable.

The fertile or cultivable areas are most probably the exceptions to the general character of the soil between these two mountain chains, and are of limited extent.

The soil, too, of a large portion described as fertile, is most probably better adapted to grazing than to farming. The valley of St. Mary's, and other mountain valleys in that region, and west of the Bitter Root mountains, are represented to have dark gravelly soils. The prairies on the Columbia river are also more or less gravelly. The middle and western parts of the plain of the Columbia are sandy, rocky, and sterile; here and there are *swales*, having rich mould; bunch-grass, varying in degree of sparseness of growth, is found over a large portion of its surface.

Lieutenant Mullan says of the St. Mary's valley, which has been considered as a kind of standard, "the soil of the valley of the Bitter Root (St. Mary's) is fertile and productive, well timbered with pine and cotton-wood, but whose chief *characteristic* and *capability* is *that of grazing large herds of cattle,* and affording excellent mill-sites along the numerous mountain streams."

Probably about one-fourth of the area of the valley is cultivable, the remainder being suitable for grass-lands only.

Dr. Suckley, referring to the Hell Gate, Bitter Root, Clark and Columbia rivers, and to the Dalles, says, "there are a few pieces of excellent land along these rivers." The valley of Clark's fork is heavily timbered with pine; there is no grass.

Within the limits of Washington Territory, between the Cascade and Rocky mountains, there are 7,356 Indians. Within the same Territory, west of the Cascades, the areas being as 3 to 1 about, there are 6,903 Indians. This may give some indication as to the capabilities of the soil for supporting animal life.

West of the Cascade mountains there are generally prairies, soon exhausted by cultivation, but offering good grazing; clay formations that are arable, and rich river bottoms. The fall of rain in the year is about 47 inches; the temperature is moderate.

Governor Stevens estimates that there are 4,000 square miles of tillable land on the eastern slopes of the Rocky mountains, and that the mountain valleys on the western slopes contain 6,000 square miles of arable land.

The preliminary report of the geologist of the party, made from Washington Territory, where he was still engaged in the field when the report of Governor Stevens was prepared, failed to reach the latter, who thus was not afforded the means of correcting opinions formed from those appearances of fertility presented by the growth of grasses, &c., which are liable to mislead, especially after traversing a region devoid of such verdure. A more thorough examination of the country and soil proves that very little, if any, of the eastern slopes of the Rocky mountains is suitable for cultivation; and that the valleys of the streams east of the mountains, and those west, are capable of sustaining merely small agricultural settlements. The greater portion of these valleys are only suited for grazing lands; and this mountain region, described as containing 10,000 square miles of arable land, admirably adapted by nature for a grazing country, can never sustain a large agricultural population.

There must be some numerical error in the estimate of the area of the grassed lands between the Bitter Root and the Rocky mountains, since careful measurements in the office make it much less than that given above.

It is not probable that the area of cultivable soil within the limits mentioned, east and west of the Rocky mountains, will exceed one-tenth of the area stated—that is, 1,000 square miles.

The character of country along the route from St. Paul to Seattle may be summed up as follows:

From St. Paul to Little Falls, fertile soil	109	miles.
From the Mississippi river at Little Falls to Dead Colt Hillock, the soil is fertile—the distance is about	166	"
From that point to the crossing of Revière à Jacques, near the 99th meridian, the change from fertility to an uncultivable condition takes place	66	"
Thence to the crossing of Sun river, a distance of 752 miles, the prairie is uncultivable; the river bottom of the Missouri in part, those of Jacques river, Mouse river, and of other streams, possessing a cultivable soil	752	"
We then have mountain region of 404 miles, a well-wooded district to the Spokane river, with mountain valleys of partly cultivable soil, and prairies of the same character	404	"
(The sum of the areas of the cultivable soil in the Rocky mountain region being about 1,000 square miles.)		
From the Spokane river to the crossing of the Columbia, 10 miles above Fort Wallah-Wallah, over the barren plain of the Columbia	142	"
Thence to the Cascades, an uncultivable though grazing district, about	192	"
Thence to Seattle, on Puget sound, over cultivable land, about	194	"
Total	2,025	"

So that of the 2,025 miles from St. Paul to Seattle, on Puget sound, we have only a space of about 535 miles of fertile country; the remaining 1,490 miles being over uncultivable prairie soil, or mountain-land producing only lumber, with the limited exception of occasional river-bottoms, mountain-valleys, or prairie.

CLIMATE.

Of the 47 inches of rain that fall yearly at Steilacoom, Puget sound, 15 inches fall during the autumn months, and 20.6 inches during the winter months. At Fort Laramie, on the plain just east of the Rocky mountains, 23.5 inches rain fall during the year. Ten inches of these 23.5 fall during the spring, and only 3.4 inches during the winter. At Fort Snelling about 25 inches fall during the year: of this only 2 inches fall during the winter; 6.8 inches during the spring; 10.2 inches during the summer; and 5.7 inches during the autumn. The excessive autumn and winter rains of Puget sound are converted into spring rains at the eastern base of the Rocky mountains, and into summer rains at Fort Snelling. It is probable that the Bitter Root range has a heavy winter precipitation, and, arresting a large proportion of the moisture from the west, protects the Rocky mountains from it and from heavy winter snows—a circumstance favorable to the construction and working of a railroad through the Rocky mountains in this latitude. It appears probable, too, that the greatest precipitation in this region takes place during the latter part of winter and the early part of spring. Mr. Tinkham, in crossing the Bitter Root range, found two and three feet of snow in the latter part of November; and, before he left the camp on the summit of the pass, (7,250 feet elevation) the snow increased to the depth of six feet.

The evidence adduced by Gov. Stevens shows that no obstruction to a railroad need be apprehended from snow across the plains through the passes of the Rocky mountains, and thence by way of the Columbia River Pass to Puget sound, though the great rise of the Bitter Root and Flathead rivers and Clark's fork, in the spring freshets, indicates a large deposition of snow at their sources. It is reported, that two winters previous to that of Gov. Stevens's party being there, (winter of 1851–2,) a party of Flathead Indians were prevented from returning to their village, in St. Mary's valley, although only two or three days' travel from it, by the passes being blocked up with snow; they were on that account obliged to pass the winter in one of the valleys east of St. Mary's. This does not, however, make it impracticable for a railroad, since it was the accumulation of drift of the whole winter, and on a railroad track it would be removed as fast as it fell. The meteorological observations made at Fort Benton and in St. Mary's valley during the past year, will be interesting. The amount of winter rains converted into snow, give pretty sure indications, in these climates, of the greatest depth that may be encountered, allowing one foot of snow to one inch of rain.

With respect to the temperature of the route: San Francisco, in about latitude 37°, has a winter temperature of 50° Fahrenheit; Fort Moultrie, Charleston harbor, about latitude 33°, has about the same winter temperature, 50° Fahrenheit; Steilacoom, Puget sound, about latitude 47°, has a winter temperature of about 39° Fahrenheit—the same, nearly, as that of Fort Monroe, Old Point Comfort, Chesapeake bay, in latitude about 37°, which is 40° Fahrenheit.

The mean winter temperature of Steilacoom, Puget sound, is 39°; of San Francisco, 50°.4; showing an increase of about 1° of Fahrenheit for 1° of latitude, which is the change generally on that coast within those limits, corresponding nearly with the eastern part of Europe, as given by Humboldt.

On the Atlantic coast, the change from south to north in our territory, as far north as Boston, is about 2°.4 Fahrenheit for 1° of latitude. The meteorological observations that I have access to, those of the Surgeon General's bureau, do not show whether this change of proportion takes place gradually between the shores of the two oceans, or if it be sudden.

Along the Mississippi river the decrease of temperature for increase of latitude is somewhat less than on the Atlantic.

Along the chain of the Rocky mountains the change of temperature in some instances corresponds with the Atlantic, sometimes with the Mississippi; in other cases, the proportionate decrease of temperature going north is greater than either. The observations on the northern route, as given in the report, are too imperfect to enable a satisfactory comparison to be drawn between them and those made at points further south. So far as any conclusions can be deduced from them, they indicate that the law of change of temperature along the Rocky mountain range for change of latitude is nearly the same as that along the Mississippi or the Atlantic coast—the points being reduced to a common elevation by the allowance of 1° Fahrenheit for every 300 feet of elevation. It is supposed, also, that no great modifying influences from local causes exist—such, for instance, as the Great Salt lake. If, then, we find points along the northern route, among the mountains, with winter temperatures not exceeding those many degrees further south, in the same mountain chain, it will be due simply to the low elevation of the former. That the winter climate is severely cold on the prairies between Fort Benton and the mountains, and in the Rocky mountain passes, is inferrible from the reports of Mr. Tinkham and Lieutenant Grover. That the cold is excessive on the prairie over the whole route is evident, from the meteorological information contained in the report. Mr. Tinkham, after crossing the summit of the Marias Pass, (latitude 48° 30′ about,) found, on the 20th of October, at an elevation of 5,600 feet, (300 feet higher than the proposed tunnel in Lewis and Clark's Pass,) the snow-banks of the previous winter still resting on the borders of the shaded ponds or small lakes; and in the prairies, twelve miles from the summit, he found four inches of snow. On the route to Fort Benton, (from this pass,) between the 20th and 27th of October, distance 136 miles, the thermometer was once or twice as low as 3° Fahrenheit.

Lieutenant Grover crossed the Rocky mountains through Cadotte's Pass, in January of 1854, and while in the pass the thermometer descended as low as 21°, 19°, 15°, below zero of Fahrenheit.

The meteorological observations of the Medical department of the army, furnished me from the Surgeon General's office, form the data, in addition to those given in Governor Stevens's report, for the deductions drawn respecting the amount of snow, rain, temperature, &c.

GENERAL REMARKS.

The two principal favorable characteristics of the northern route, are its low profile and low grades; the prairies extending in this latitude from the Mississippi to the base of the mountains, fifteen or twenty miles from the summit, in about longitude 112° and 113°, a distance by the railroad route of 1,000 miles. Its proximity to, and connexion with the Missouri and Columbia rivers and their principal tributaries, is also favorable to its construction.

The road leaves the Mississippi river, at Little Falls, at an elevation above the sea of about 1,100 feet. Between Mouse and Missouri rivers it has attained an elevation of more than 2,000 feet. Its general elevation on the Missouri and Milk rivers is 2,200 feet. Leaving Milk river, it crosses the high prairies towards Lewis and Clark's and Cadotte's Passes; at the distance of 100 miles on the travelled, and 130 on the railroad location from these passes, the elevation is about 3,000 feet. Upon entering the passes it is about 4,600 feet, the summits being respectively 6,300 and 6,044; and the proposed tunnels at elevations of 5,300 and 5,000 feet respectively.

After passing the summit we descend to the elevation of 3,000 feet, at about 100 miles west of it, by following the valley of the Bitter Root, and 130 miles west of it, following the Jocko, making the whole distance on the railroad route, exceeding an elevation of 3,000 feet, to be about 260 miles. At the junction of the Bitter Root and Flathead rivers, which forms the commencement of Clark's fork, the elevation is about 2,500 feet, and at Pend d'Oreille lake about 1,600 feet. In crossing the dividing ridge between Clark's fork and the Spokane river, and the Great Plain of Columbia, between the Spokane and Columbia, the elevation attained is about 2,400 feet. If the mountain district be considered to extend from Sun river to Pend d'Oreille lake, the route runs through 310 miles of it; if to the Spokane river, about 400 miles.

The sum of the ascents in crossing main divides or ridges going from Fort Vancouver, elevation 0, to St. Paul, elevation 828 feet, is about 9,500 feet; from Seattle, on Puget sound, to St. Paul, the sum would be 10,000 feet.

The descents, going west, would be, respectively, above 8,700 and 9,200 feet.

Applying Latrobe and Knight's rule for equating grades, the effect of these ascents and descents, on the working of the road, would be equivalent to 343 miles in the first instance, and 362 in the other.

The distance from St. Paul to Vancouver is 1,864 miles.
" " Seattle 2,025 miles.
The equated distances become (to Vancouver) 2,207 miles.
" " (to Seattle) 2,387 miles.

The numbers just given are not necessarily a measure of the sum of all the ascents on the route, since in making any one of the great ascents the road may and does rise and fall repeatedly. These minor undulations careful instrumental surveys only can measure accurately.

If the prairies give a low profile, they at the same time have the disadvantage of furnishing neither lumber nor fuel, nor a good supply of water, and, at some seasons, none at all over certain distances. The cotton-wood on the river bottoms (of which but a limited supply exists) should not be depended upon for fuel—it is no doubt of small growth; that of large growth, on the rich lands of the Mississippi, is used for fuel on western steamboats, but the small growth will hardly prove fit for use in locomotives. It will not, certainly, be good fuel for that purpose. Opinions differ as to its fitness for ties, even for a temporary track by which to reach supplies of better lumber for a permanent road. By some it is said to be totally unfit for this purpose, as it will not hold a nail.

TIES, LUMBER, &C.

The points of supply of good timber are Little Falls, Mississippi river; Red river, Mouse river, Bear's-Paw mountains, the Three Buttes, and the western slopes of the Rocky mountains.

The distances apart of these points, over which ties and lumber generally must be transported up the Missouri, are—

From Little Falls to Red river, 100 miles;
From Red river to Mouse river, 260 miles;
From Mouse river to Bear's-Paw mountains, 470 miles;
From Bear's-Paw mountains to western slope of Rocky mountains, 170 miles; or,
From Three Buttes to western slope of Rocky mountains, 130 miles.

West of the Rocky mountains the country is well supplied with lumber throughout, except for the space of 110 miles in crossing the plains of the Columbia.

It will cost to transport lumber great distances by the built portions of the road, $4 50 per 1,000 feet per 100 miles.

FUEL.

Supposing the road supplied with fuel, in the districts destitute of it, from the coal-fields of Illinois, the nearest point to St. Paul is Port Byron on the Mississippi, 330 miles from St. Paul, and coal will probably cost at St. Paul from $4 to $6 per ton.

As coal can be transported three and a half times as far as wood, and be equally economical for locomotive use, it may be used over 600 miles of the northern route, beginning 100 miles west of the Mississippi, at an average cost to the road of from $15 to $17 per ton. This estimate is made merely to show what would be the cost over these portions of the route if cotton-wood cannot be used for fuel. The cost of wood per cord, for 200 miles east of the Rocky mountains, would be in the same proportion. The sources of supply of good fuel from Red and Mouse rivers, Bear's-Paw mountains, and the Three Buttes, will of course be availed of, so far as they can be economically.

The navigation of the Missouri river to Fort Union is closed by ice four or five months in the year; that of the Mississippi, at St. Paul, about four and a half months, from the latter part of November to early in April.

TUNNELS.

In forming a judgment upon the practicability and length of time required to execute a tunnel, the only safe guide is the result of well-tried means of excavation.

When the question is the construction of a tunnel of several miles in length through rock, the depth from the surface being so great that shafts cannot be resorted to, the tunnel is only practicable if some machinery can be applied to the excavation so as to bring its time of completion within reasonable limits. The rate at which rock excavation could be made in it, by the only means as yet successfully tried, would be so slow that the project would be considered entirely impracticable. It does not appear that any of the machines invented for this purpose have as yet proved successful, and no tunnel project depending upon their use can be considered practicable until they have proved successful in trials of every kind.

In hard rock, where continual blasting is required, the rate of progress may be taken at 10.5 inches every 12 hours. On the Black Rock tunnel, Reading railroad, through graywacke slate, the progress was but little more than 0.6 of a foot every 24 hours, or 2,387 spaces of 12 hours each, for constructing 1,782.5 feet in length of the tunnel.

In the Blue Ridge tunnel, on the Virginia Central railroad, the progress has been less than two feet per day of 24 hours.

Tunnels two, three, and four miles in length, in rock or partly in rock, at depths exceeding 1,000 feet below the summit, in severely cold climates, at great distances from thickly inhabited districts, form serious objections to any route.

The more southerly passes of the Rocky mountains partly explored, in connexion with this route, have the advantage of not requiring tunnels.

ESTIMATE.

Governor Stevens's estimate of the time required to build the road cannot be founded upon the experience of any great line of railroad built in the United States.

The estimate of 25 per cent. to the cost at eastern prices from the Bois des Sioux to the Rocky mountains, and thence to the Pacific of 40 per cent., is, in my judgment, too small an increase. It would have been safer, probably, to have added 100 per cent. to the cost at eastern prices, from the crossing of Milk river to the Pacific. Under this supposition, the corrected estimates of $105,076,000, of $112,121,000, of $105,091,000, and of $129,806,000, would have added to them $30,690,000, $33,750,000, $30,690,000, and $41,440,000, and would become—

Cost of road to Seattle by the Yakima Pass, using the long tunnel, 1,875 miles..	$135,766,000
Cost of road to Seattle by the Columbia valley and the Cowlitz river, 2,025 miles	145,871,000
Cost of road to Vancouver, 1,864 miles..	135,781,000
Entire system, St. Paul to the Columbia, with branches down the Columbia and across the Cascades, and a connexion from Seattle direct to the Columbia river, 2,175 miles, at a cost of..	171,246,000
To the above original sums Governor Stevens adds for engineering and contingencies..	5,000,000

It does not appear whether equipment is included in the estimate; if it is not, about $3,000,000 should be added to the above sums on that account. If a full equipment has been included, $10,000,000 should be subtracted from each of the preceding sums, to bring the estimate in accordance with those of the other routes; and under this latter supposition the estimate finally becomes—

Cost of road to Seattle by the Yakima Pass, using the long tunnel, 1,875 miles.	$130,766,000
Cost of road to Seattle by the Columbia valley and the Cowlitz river, 2,025 miles	140,871,000
Cost of road to Vancouver, 1,864 miles..	130,781,000
Entire system..	166,246,000

CHAPTER II.

ROUTE NEAR THE FORTY-FIRST AND FORY-SECOND PARALLELS OF NORTH LATITUDE.

That portion of this route from the Missouri river to Fort Bridger, on a tributary of Green river, has not been explored with a special reference to the practicability of constructing a railroad, and the reports do not contain all the details necessary to the elucidation of the subject. The information respecting it is to be found in the reports of Colonel Fremont and Captain Stansbury.

From Fort Bridger to the Pacific, the route has been explored and reported upon by Lieutenant E. G. Beckwith.

The accompanying report upon the route east of Fort Bridger, by Lieutenant G. K. Warren, is based upon the reports of Colonel Fremont and Captain Stansbury.

The eastern terminus of the route may be either Council Bluffs or Fort Leavenworth. It ascends the Platte and passes through the eastern chain of the Rocky mountains, (the Black Hills,) either by the North fork and its tributary, the Sweet Water, or the South fork and a tributary called Lodge Pole creek. By the former it enters upon the great elevated table-land in which the headwaters of the Platte and the Colorado of the west are found, by the South Pass, the ascent having been gradual from the first mountain gorge in the Black Hills, 30 miles above Fort Laramie, to the summit of the so-called pass, a distance of nearly 300 miles, bounded, generally, on either side, by mountains. This table-land, including the Laramie plains, extends 300 miles from east to west, and 100 from north to south. Its soil is light and dry; its growth artemisia, with a little scattered grass, a border of the latter being found on the water-courses, and scattered cedars upon the mountains in the western half.

By the second route, the same difference of elevation is overcome by the Cheyenne Pass, probably in about the distance usual in the Rocky Mountain passes, the route thus entering the Laramie plains, which may be considered to form the eastern part of the Great Plateau first mentioned.

From the Missouri river to the entrance of the Black Hills, the route resembles others from the Mississippi to the Rocky mountains, fully discussed elsewhere, and needs no special mention.

It may be estimated to cost $35,000 per mile for construction and equipment, 25 per cent. having been added to cost at eastern prices for one-half the distance.

Following the northern fork of the Platte, 30 miles above Fort Laramie, 520 from Council Bluffs, and 755 from Fort Leavenworth, this line enters the Black Hills through a gorge with vertical walls from 200 to 400 feet high; thence to the Red Buttes, 117 miles, the road must cross many streams coming from the Black Hills, that have cut deep ravines in the earth near their mouths. The construction will be costly.

From the gorge of the Red Buttes to the Hot Spring gorge, 34 miles, the route lies through a valley. Above this point the Platte passes through exceedingly rugged ground, and is walled in by cañons.

The road should leave the river just below the Hot Spring Gate, turn to the north, and cross the hills, the peaks of which are 800 feet above the Platte, giving an average grade of 133 feet to the mile for six miles, but which doubtless will be found steeper than the average near the summit, descend 10 miles, with an average grade of 56 feet to the mile, to the Sweet Water, a branch of the Platte. This stream occasionally cuts through spurs, making cañons, that of the Devil's Gate being through granite; but it is represented to be generally rather open, with abundant grass on the immediate bottoms, though the hills on either side are rocky and bare. At the source of the Sweet Water, the summit of the South Pass is attained, its elevation being 7,490 feet, the distance from the first gorge in the Black mountains being 291 miles, and from Fort Laramie 321 miles.

This whole section, from the first gorge to the summit of the pass, 291 miles, will be expensive, and is assimilated, in amount of work required, to the Baltimore and Ohio railroad, and may be estimated, therefore, to cost, for construction and such equipment as will be required for first use, 50 per cent. being added for increased cost over eastern prices, $75,000 per mile.

The only practicable route known, from the South Pass to the Great Basin, is by Fort Bridger through the passes in the Wahsatch mountains, explored by Lieutenant Beckwith. The route would traverse the Great Plateau, following Sandy creek, a tributary of Green river, to the crossing of the latter, from which point to Fort Bridger no doubt exists of its practicability. The distance is 131 miles; the elevation of Fort Bridger, 7,254 feet.

The amount of work on this section would be considerably less than that on the preceding, and the construction and equipment may be estimated to cost $50,000 or $55,000 per mile; 50 per cent. being added to the cost at eastern prices.

From Council Bluffs to Fort Bridger the distance is 942 miles, and from Fort Leavenworth 1,072 miles.

The points of supply for ties, lumber, &c., will be found only at the eastern extremity, on the Black Hills and on the Wind River mountains, the distances apart being 500 and 300 miles. Fuel for working parties will be found along the Platte; none on the streams of the great plain west of the South Pass. Good building-stone is found on the Sweet Water.

Coal is to be had at the eastern terminus, and extensive beds exist on Green river and its affluents; the distance apart of the points of supply being about 800 miles.

The route along the South fork of the Platte and Lodge Pole creek, by the Cheyenne Pass and Bridger's Pass, is not so well known as the other. Lodge Pole creek has never been continuously explored, and there is no profile of this route. Respecting the Cheyenne Pass, Captain Stansbury says his "examinations fully demonstrate the existence of a route through the Black Hills, not only practicable, but free from any obstructions involving in their removal great or unusual expenditure." He gives no estimated grades, and had no barometer or other instrument for measuring elevations.

From the Cheyenne Pass to Fort Bridger "the country can be crossed in many places, the choice being determined by considerations of fuel and water." That selected crosses the divide between the waters of the North fork of the Platte and Green river, by Bridger's Pass.

The expense of construction on this route, from the Cheyenne Pass to Fort Bridger, would probably be less than that along the Platte. The rock-cutting would be small in amount, and in soft material. It crosses ground much cut up by ravines and gullies, and in many places easily torn up by the torrents, probably requiring care in location, and much masonry, which the absence of good building-stone would render expensive. Captain Stansbury says an extensive embankmentwill be required on Muddy creek, west of Bridger's Pass. The distance from Council Bluffs to Fort Bridger by this route is 897 miles.

A reliable comparison of the cost of the two routes cannot be made with the present information; and in the estimate of the cost of the whole route, I shall adopt that by the South Pass, though Captain Stansbury, who examined both, is positive in his preference of the other.

It is probable that no unusual difficulty may be apprehended from the depth of snow between Fort Laramie and Fort Bridger. The quantity that falls is not exactly known.

The eastern terminus of the exploration of Lieutenant Beckwith upon the route of the 41st parallel is at Fort Bridger, situated on Black's fork, a tributary of Green river, at an elevation of 7,254 feet above the sea. The line ascends the divide between the waters of Green river and those of the Great Salt lake, by the valley of Black's fork or of one of its tributaries, with grades of 69.5 and 40.3 feet per mile. The summit is a broad terrace at the foot of the Uinta mountains, and has an elevation of 8,373 feet. From this point the line descends over the undulating country separating the Uinta and Bear River mountains, crosses the head of Bear river, and, entering the valley of White Clay creek at its head, follows that stream to its junction with Weber river.

The Wahsatch mountains now intervene between this rolling country and the Great Salt lake, and the passage through them may be effected by following Weber river, or by ascending to near the sources of the Timpanogos, and descending that stream—both being affluents, directly or indirectly, of the Great Salt lake. The distances are about the same to their common point on that lake.

There are cañons upon both these streams; that of the Timpanogos is ten miles in length, and narrow, being from 100 to 300 yards in width. It is direct in its general course, but must be bridged at several points to avoid short curves. The sides are of blue limestone, and will require rock-blasting at some points. The river, thirty yards wide, descends with a powerful current, and, when most swollen, is six feet above its ordinary level.

The upper cañon, on Weber river, is rather a gorge, or defile, eight and a half miles long. The mountains rise to a great height above it, and are rocky and precipitous, and much broken by ravines. The river is winding, and it will be necessary to cross it frequently.

The lower cañon, near the borders of the valley of the Great Salt lake, is four miles long, direct, with an average width of 175 yards, the stream being thirty yards wide, and impinging, frequently, with great force against the base of the mountains, which are sufficiently retreating to admit of the practicable passage of a railway.

Entering the valley of Great Salt lake from either this or the Timpanogos cañon, there is no obstacle to the construction of a railway, passing by the south end of the lake, and crossing the Jordan, Tuilla valley, and Spring or Lone-Rock valley, to its west side.

By the valley of the Timpanogos, the distance from near Fort Bridger to the south end of the Great Salt lake, on the western side of the valley of the Jordan, is 182.55 miles—the greatest grade required, eighty-four feet to the mile.

The amount of work required on this section, excepting that along the cañon, will not, in the opinion of Lieutenant Beckwith, be great.

"From the western shore of Great Salt lake to the valley of Humboldt river the country consists alternately of mountains, in more or less isolated ridges, and open, level plains, rising gradually from the level of the lake on the east to the base of the Humboldt mountains on the west—that is, from 4,200 feet to 6,000 feet above the sea." West of the Humboldt mountains the country is of the same character, the plains declining until, at the west shore of Mud lake, usually called the foot of the Sierra Nevada, the elevation is 4,100 feet. Here the ground rises again to the plain, table-land or basin of the Sierra Nevada, whose elevation is 5,200 feet above the sea. It is covered with irregular spurs, ridges, and isolated peaks, rising a few hundred feet, leaving a plain surface in a north and south direction sometimes ten miles, sometimes only a few hundred yards, in width. In an east and west direction this plain is about forty miles in extent, bounded at either end by mountains, the summits of the passes through which are 400 and 500 feet above the plain, and which prevent its drainage into the Great Basin, or into the waters of the Pacific. This plain, or basin of the Sierra Nevada, might properly be called a part of the Great Basin, since it is in every respect similar to it.

The mountains in this space of 500 miles, between the Great Salt lake and the foot of the Sierra Nevada, have a general north and south course; occasionally cross-spurs close the valleys to the north and south, but more frequently this isolation is only apparent. They are sharp, rocky, and inaccessible in many parts, but are low and easily passed in others; their general elevation varies from 1,500 to 3,000 feet above the valleys, and but few of them retain snow upon their highest peaks during the summer. They are liberally supplied with springs and small streams, but the latter seldom extend far into the plains. At the time of melting snows there are many small ponds and lakes, but at other seasons the waters are absorbed by the soil near the base of the mountains. Grass is found in abundance upon nearly every range; but timber is very scarce, a small scattered growth of cedar only being seen upon a few ranges. East of the Humboldt mountains, the growth of cedars is more abundant and the grass better. The valleys rarely have a width east and west of more than five or ten miles, but often have a large extent north and south. They are irregular in form, frequently extending around the ends of mountains, or uniting to succeeding valleys by level passages. The greater part of the surface of these valleys is merely sprinkled by several varieties of sombre artemisia, (wild sage,) presenting the aspect of a dreary waste; though there are spots more thickly covered with this vegetation, yet the soil is seldom half covered with it for a few acres, and is nowhere suitable for settlement and cultivation. Immediately west of Great Salt lake there is a desert plain of mud, clay, and sand, impregnated with salt, seventy miles in width from east to west by its longest line, and forty at a narrower part further south—thirty miles of which must be piled for the passage of a railroad across it.

A railroad may be carried over this series of plains, and around the mountain masses, at nearly the general level of the valleys. The route in this manner reaches the foot of the Humboldt mountains—a narrow but elevated ridge, containing much snow during most of the year—and crosses them by a pass nine miles long, about three of which are occupied by a narrow, rocky ravine, above which the road should be carried on the sloping spurs of the mountains on the western descent. Elevation of summit, 6,579 feet above the sea. At the time when passed, 21st May, snow covered the high peaks above it, and a few drifts extended into the ravines down to the level of its summit.

The descent is now made to the open valley of Humboldt river, which is followed for about 190 miles. The steepest grade proposed in the pass of Humboldt mountain is eighty-nine feet per mile for eight miles, but this can be reduced by gaining distance to any desirable extent.

The Humboldt river, as described by Colonel Fremont, is formed by two streams rising in mountains west of the Great Salt lake—the Humboldt mountains. Its general direction is from east to west, coursing among broken ranges of mountains; its length about three hundred miles. It is without affluents, and terminates near the foot of the Sierra Nevada in a marshy lake. It has a moderate current, is from two to six feet deep in the dry season, and probably not fordable anywhere below the junction of the two streams during the melting of the snows. The valley varies in width from a few miles to twenty, and, excepting the immediate river-banks, is a dry, sandy plain, without grass, wood, or arable soil. Its own immediate valley (bottom) is a rich alluvion covered with blue grass, herdsgrass, clover and other nutritious grasses, and its course is marked through the plain by a line of willow, serving for fuel.

Of the three lines from the Humboldt river to the foot of the Sierra Nevada, the best is that by the Noble's Pass road, as it avoids the principal range of mountains crossed on the line followed a few miles south. The line followed crosses two ranges of the general character of the Basin mountains, and reaches the foot of the Madelin Pass of the Sierra Nevada, on the west shore of Mud lake, in a distance of 119 miles, and at an elevation of 4,079 feet above the sea. The topographical features of the Great Basin present extraordinary facilities for the construction of a railroad across it. By the route followed, the distance is more than 600 miles from the debouche of the Timpanogos river to the west shore of Mud lake.

In this latitude, the Sierra Nevada was found to be a plateau about 5,200 feet above the sea, forty miles in width from east to west, enclosed at these limits by low mountains, the summits of the passes through which are four and five hundred feet above its surface. The plain is covered with irregular spurs, ridges, and isolated peaks, rising a few hundred feet, limiting it in a north and south direction sometimes to a space of a few hundred yards, and in others to that of ten miles. These spurs, &c., on the eastern portion of the plateau are sparsely covered with cedar; on the western, heavily covered with pine.

There is no drainage from this plain, the waters of a few small streams and springs forming grassy ponds upon its surface. In its general features it is similar to the Great Basin, excepting that as more rain falls upon it, the vegetation is comparatively luxuriant.

The two routes by which this plain is reached from the Great Basin, and the descent afterwards made to the Sacramento river, are described in detail in the concluding chapter of Lieutenant Beckwith's report.

That called the Madelin Pass, the more northern, is most probably the better of the two, and is the only one necessary to be considered. Leaving Mud lake, it ascends by the valley of Smoky creek, for three miles through a narrow gorge (from 100 to 150 yards wide) in an outlying spur of the Sierra Nevada. The sides, formed of coarse, crumbling, metamorphic rock, much broken by side ravines, rise abruptly to the height of from fifty to two hundred feet on the south, and to a much greater elevation on the north side. The course of the gorge is direct, and can be followed without difficulty by a railroad. Above the gorge, the valley expands to the width of half a mile and a mile, and again becomes narrow; being enclosed on the north by retreating mountain spurs, the means of ascending by a very uniform grade is afforded. Near the summit the grassy ascent is but 200 yards wide, with rocky hills rising gently two or three hundred feet above it. The pass is, thus far, of a very favorable character; the length of the ascent is 22.89 miles, the difference of elevation 1,172 feet, the altitude of the summit 5,667 feet, and the steepest slope 75 feet per mile.

By a gentle descent for five miles the plateau is gained, and then crossed to the low ridge enclosing it to the west, the summit elevation of which, 5,736 feet, is attained by following a ravine valley, sometimes a mile, at others a quarter of a mile wide, bounded by ridges rising gently on either side. The descent is commenced by a narrow ravine, and is at first rapid, 420 feet in 2.4 miles; but the ravine soon widens, and a creek descends from it with a free current, a tributary of the Sacramento river. A cut is proposed at the summit 120 feet deep, running out to the surface at either end, making a length in all of four miles, and a grade of 124 feet per mile for 2.4 miles. It may be preferable to tunnel instead of cutting, or to cut only one-half the depth proposed.

The open plain of Round valley, on the Sacramento, is reached 15 miles from the summit, (difference of elevation 1,300 feet,) over one-half of which distance the road must be located along the mountain on the northeast side of the stream. Although the greater number of ravines is found on that side, there are no cañon walls, two of which exist on the southwestern side.

From this point the route lies over the smooth plain of Round valley to the head of the first cañon on the Sacramento, a distance of 15 miles.

This cañon is a formidable obstacle to be overcome. Its entire length is nearly 14 miles, succeeded by an open valley of similar extent, which is followed by a second cañon nine miles in length, of the same character as the first. From the mouth of Canoe creek, four miles below the foot of the second cañon, for the space of 96 miles the course of the Sacramento lies entirely through heavily timbered mountains, which rise precipitously from the river-banks to the height of from 1,500 to 2,000 feet above the stream. Its course is very sinuous, with all varieties of curves greater than a right-angle, and is seldom entirely straight for two miles consecutively. The construction of this portion of the route, 136 miles in length, would be one of no ordinary difficulty or expense under the most favorable circumstances of dense population, and the facilities of railroad construction which it would afford. It is impossible, with the data presented, to form a reliable opinion of its probable cost. To set down the amount of labor required at that of the Hudson river railroad, will be, it appears to me, to under-estimate it, since only a portion of that railroad, 144 miles long, runs through the mountainous district, whereas the whole of this is of that character.

As an intelligible description of these portions of the river cannot be more brief than that of Lieut. Beckwith, I make the following extract from his resumé of the route:

EXTRACT FROM THE REPORT OF LIEUTENANT BECKWITH.

"Round valley, through which the Sacramento river descends from the northeast, and through which a road can be carried at pleasure, extends for fifteen miles below this point to the head of the first cañon of the Sacramento. This cañon is a formidable obstacle to be overcome. Its entire length is 13.74 miles, succeeded by an open valley of similar extent, which is followed by another cañon, 8.95 miles in length, of the same character as the first. The river, as it enters the first cañon, is from thirty to forty feet wide, flowing with a rapid current over a bed of rocks, and it is sixty feet wide as it enters the second cañon just below the junction of Fall river, and flows over a similar bed with an equally swift current. At their heads these cañons are vertical, metamorphic rocks, eighty feet high, with large masses of fallen rocks accumulated at the bases of the walls. The first is cut through a high plain for six miles; the plain then rises somewhat, and is surmounted by high sloping ridges, rising five or six hundred feet above it, and the cañon becomes much broader and its walls more elevated for two miles, to where it makes a large bend to the north; below this the walls gradually decrease, and in two miles the cañon opens to the width of half a mile, which it preserves for three miles to the succeeding valley. The highest portions of the walls rise two hundred feet above the stream, with an accumulation of fallen rocks extending half way to the top. For eight miles the course of the cañon is direct. It then makes a long bend to the north, and is followed by two or three short curves, but with a generally direct course. Its open part is timbered and its walls less abrupt, and on the right bank of the stream the mountains, followed by the river, extend considerably into the plain of Fall river. The most favorable line for the passage of a railway leads along the plain on the north side of the river, and descends the sides of the rocky hills which surmount it, and continues on the side of the mountain until it enters the plain of Fall river. The second cañon is only less formidable than the first because of its less extent. Its character is entirely the same, except that it is surmounted near its head by sloping mountain ridges of a similar altitude to the former. But on the south side, a few miles distant, the ridge subsides into rocky volcanic hills and plains. It will require a minute survey to determine the most practicable line by which to pass it; but it is probable that the best line will be found to leave the river a few miles above Fall river, and to pass around the ridge extending southward, and again return to the Sacramento at the mouth of Canoe creek, four miles below the foot of the cañon, avoiding short curves which must be encountered in it, and diminishing the amount of rocky cutting; for, in the passage of each of these cañons the expense will be very heavy from this cause, and can only be estimated after an extensive and complete survey.

"For ninety-six miles below the mouth of Canoe creek to seventeen miles above Fort Reading the course of the Sacramento lies entirely through heavily-timbered mountains, which rise precipitously from the river-banks to the height of from 1,500 to 2,000 feet above the stream. Its course is winding, with all varieties of curves greater than a right-angle, and it is seldom entirely straight for two miles consecutively; but its general courses are more uniform.

"The foot of the mountains along the stream is often obstructed by fallen rocks to such an extent as to prevent its passage on horseback, and it is also obstructed by fallen timber and dense thickets of bushes; but the obstructions from fallen rocks are favorable rather than otherwise, for the construction of a railroad, as they will serve to form its sub-structure. At many points, but for short distances only, the way is obstructed by rocks in place. The road will require to be carried on the side of the mountains, a few feet above the stream at high water, throughout this entire section to the open valley of the Sacramento, whence it can be continued on the open plain."

The estimate of cost may be set down at not less than from $150,000 to $200,000 per mile; 100 per cent. to the cost at eastern prices having been added.

Seventeen miles above Fort Reading the open valley of the Sacramento is attained, over which a railroad may be carried to the Bay of San Francisco, 250 or 300 miles distant.

The distance from Fort Bridger to Fort Reading, by the line of Lieutenant Beckwith's profile, is 1,012 miles; from Fort Leavenworth to Fort Bridger, 1,072 miles; making the whole distance from Fort Leavenworth to Fort Reading, on the Sacramento, 2,084 miles, and to Benicia 2,264 miles.

The distance from Council Bluffs to Benicia, by the above route, is 2,134 miles.

Using the line along which the route can be located in the Great Basin, about 103 miles shorter than that travelled, the distances become, from Fort Bridger to Fort Reading, 909 miles; from Fort Leavenworth to Fort Reading, 1,980 miles; and to Benicia, 2,161 miles.

The distance from Council Bluffs to Benicia becomes 2,031 miles.

TIMBER, BUILDING MATERIALS, &C.

Pine and fir are found on the Uinta mountains and terrace, and pine upon the Wahsatch mountains. Dense forests, furnishing timber of the best quality, cover the western slopes of the Sierra Nevada; the distance between these points of supply being about 700 miles. Lieutenant Beckwith is of opinion that the scattered growth of cedar upon the Basin mountains, between the Great Salt lake and the Sierra Nevada, is sufficiently large for ties, and "although it will require transporting for long distances, it is believed to be sufficiently abundant for the construction of the road."

Should this growth be found unsuitable for ties—and it has been so considered by me, in the review of the route near the 35th parallel—ties, as well as other lumber required for his portion of the route, must come from the Wahsatch or Uinta mountains on the east, and the western slope of the Sierra Nevada—the distances apart of these points being, as above stated, about 700 miles.

FUEL.

Should the coal beds in the Great Plain of Green river prove to be of such quality and extent as to admit of their being profitably worked, they will supply fuel for the use of the road for 600 miles west of that plain, or for as much more of the remaining 230 miles to the western slope of the Sierra Nevada as may be found economical. The cedar growth of the Great Basin could furnish but a very small supply of fuel.

The distance between the supply of coal near Fort Leavenworth and that of Green river may be set down at 800 miles, and to the cost of mining must be added that of transportation for a mean distance of 200 miles over the railroad, for the mean cost of the coal throughout this distance of 800 miles.

This estimate does not take into account the changes in the physical condition of the country that the construction of a railroad would effect on this as upon all other routes. When the annual burning of the prairies ceases, it is thought that trees will be found in many places now destitute of them—that a greater amount of precipitation will then take place, the forest growth be extended, and thus not only supplies of lumber, fuel, &c., be found where none now exist, but a gradual amelioration of soil likewise take place.

SNOW—CLIMATE.

The information respecting the amount of snow to be met with in the ravines of the mountain passes, and cañons, and respecting the winter climate of these portions of the route, is meagre. Apparently, Lieutenant Beckwith does not apprehend unusual difficulties in the working of a railroad on the route from this cause. That the winter is long and severe on the most elevated portions, especially on the great plateau and divide between the waters of Green river and the Great Salt lake, is to be inferred from the fact that when Lieutenant Beckwith's party was on this divide, about the 10th of April, the streams were not swollen, and they could not discover that the depth of snow (from 12 to 16 inches) was less than in winter; that is, the sun had not yet begun to melt it; on the northeast slopes of the hills and ravines it had accumulated in deep drifts. The spring freshets of Weber and Timpanogos rivers are six feet in height.

Captain Stansbury says that the Uinta mountains were covered with snow for a considerable distance from their summits on the 19th of August, 1849. The following extracts from his report may give an idea of the severity of the winter in the mountains east of the Great Basin.

Of the winter of 1849–50, he says: "I had hoped, from the representations which had been made to me of the mildness of the two previous winters, that we should be able to keep the field the greater part, if not the whole of the season; but, in the latter part of November, the winter set in with great and unusual severity, accompanied by deep snows, which rendered any further prosecution of the work impracticable."—(Page 120 of Report.)

"The winter season in the valley was long and severe. The vicinity of so many high mountains rendered the weather extremely variable; snows fell constantly upon them, and frequently to the depth of ten inches in the plains. In many of the cañons it accumulated to the depth of fifty feet, filling up the passes so rapidly that, in more than one instance, emigrants who had been belated in starting from the States were overtaken by the storms in the mountain gorges, and forced to abandon everything, and escape on foot, leaving even their animals to perish in the snows. All communication with the world beyond was thus effectually cut off; and, as the winter advanced, the gorges became more and more impassable, owing to the drifting of the snow into them from the projecting peaks.

"We remained thus shut up until the 3d of April."—(Page 122.)

The Uinta terrace and the great plain of Green river no doubt possess the usual attributes of elevated table-lands, dryness of atmosphere, and great difference between the temperature of day and night, increased by their great elevation of 8,000 and 7,000 feet. But the precipitation on the mountains is very much greater.

The winter temperature of the vicinity of the Great Salt lake is generally mild, tempered, no doubt, by the large body of salt water. That of the Great Basin generally, I should infer to be more severe.

Dr. Wozencraft, of California, visited the plateau of the Sierra Nevada about the 10th January, 1854, and found the snow on the route of Lieutenant Beckwith to average six inches in depth, and nowhere reaching eight or ten inches in its average fall; but encountered one drift of snow on the eastern slope of the Sierra Nevada, in a ravine, extending a mile, averaging two feet or two feet and a half in depth.

From the observations of the Surgeon General's department, the results of which are tabulated below, it appears that of the 6.18 inches of rain that fell during December, 1853, January and February, 1854, at Fort Reading, on the Sacramento, in lat. 40° 28′, 1.18 inch had fallen previous to the 10th January, and this fell during December; that is, about one-fifth of the whole winter precipitation of that year had fallen previous to the 12th January. On that day, 1.30 inch of rain fell.

The plateau of the Sierra Nevada partakes of the character of mountain and table-land. It is probable that on the western portion, at least as much rain falls as at Fort Reading; on the eastern portion, probably much less. Should the winter precipitation be in the form of snow, it is probable, then, that 7.6 feet of snow falls on the western part of the plateau during December, January, and February—the mean winter fall of rain at Fort Reading being 7.6 inches. The mean winter temperature of this portion of the plateau is not, probably, higher than 30°.2 Fahrenheit, that of Fort Reading being 47°.2 Fahrenheit. The temperature of the eastern portion is probably lower.

Yearly precipitation and temperature at Fort Reading, Sacramento river, California, latitude 40° 28′.

Year.	January.	February.	March.	April.	May.	June.	uly.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
1853.............	4.66	3.18	7.11	4.57	0.70	0.00	0.00	0.24	0.02	0.02	2.52	1.18	12.38	0.24	2.56	7.84	23.02
1854.............	2.90	2.10	8.00	3.07	2.40	0.00	0.00	0.00	0.00	2.26	0.87	....	13.47	0.00	3.13	6.18	22.78
Mean........	3.78	2.64	7.55	3.82	1.55	0.00	0.00	0.12	0.01	1.14	1.69	1.18	12.92	0.12	2.84	7.60	23.48

Observations for December, 1854, have not yet been received. For the mean of the two years the rain for that month has been supposed to be the same as in 1853.

Mean temperature of Fahrenheit from two years' observations.

	°		°		°		°
December..............	47.0	March................	53.74	June.................	75.30	September..............	71.64
January..............	44.25	April................	60.02	July.................	84.40	October..............	64.03
February..............	50.55	May.................	66.71	August..............	78.95	November..............	54.78
Winter.........	47.2	Spring...........	60.16	Summer..........	79.55	Autumn...........	63.53

Abundant supplies of water were found by Lieut. Beckwith on the mountains of the Basin. The season of the year when he crossed it, the spring, was the most favorable. In the dry season, the supply is, no doubt, much less abundant.

SOIL.

The only large body of cultivable soil found on this route west of the 99th meridian, is that occupied by the Mormons on the western foot-slopes of the Wahsatch mountains, forming the eastern border of the Great Basin. The following description of this fertile tract is taken from Lieut. Beckwith's report upon the route near the 38th and 39th parallels of north latitude:

"The western range of the Wahsatch mountains, standing on the eastern border of the Great Basin, is continuous, extending north and south over five degrees of latitude, from the vicinity of Little Salt lake to north of Bear river, broken only by the passage of the Sevier, Timpanogos, Weber, and Bear rivers. Its altitude at 3,000 feet above the general level of the country is quite uniform; but it occasionally falls down to 2,000, and at a few points rises to 4,000 and 4,500 feet. Its western slope is very steep—often inaccessible—presenting generally a formidable barrier to the entrance of a railroad into the Basin from the east. Many small streams descend from it; and as far as its disintegrations have been deposited at its base upon the alkaline plains of the Basin, it forms a rich soil. This line of deposite is narrow, and not continuous, but varying in width, where it is found, from two or three miles to ten or twelve at a few points, as opposite Utah and Great Salt lakes, where it occupies the entire space from the mountain to the lake shores. It is to this narrow belt of land that the Mormon settlements are almost exclusively confined, the isolated settlements being upon similar deposites in small valleys at the base of other mountains, the small mountain streams, upon which these deposites are the richest, and chiefly exist, being used for irrigation. Respectable crops of wheat and oats are produced, and barley has been cultivated to some extent; but corn does not flourish well. The grass of this district and of the higher mountain valleys is excellent; and potatoes and other roots are produced in abundance, and of a superior quality."

The area of this body of fertile soil, susceptible of irrigation by the construction of suitable works, is estimated by Lieutenant Beckwith at 1,108 square miles.

The areas of the different localities are estimated as follows:

	Square miles.
Eastern shore of Great Salt lake, from Bear river to Great Salt Lake City	350
Valley of the Jordan river	374
Valley of Tuilla, west of Oquirrh mountains and east of Cedar mountains	204
Total on Great Salt lake proper	928
Upon the borders of Utah lake	180
Total (as above)	1,108

About one-tenth of this area is susceptible of irrigation without the construction of costly works, and is tilled by the Mormons, 27,000 in number, who eagerly seek for, and occupy, small tracts of cultivable soil, if sufficiently large to support a few families, even though at great distances from the main settlement.

On this route, as on others, from the 98° or 99° meridian westward to the western slopes of the Sierra Nevada, a distance of about 1,400 miles, the soil is generally uncultivable, the exception being the comparatively limited area of the Mormon settlement, and an occasional river-bottom and mountain-valley of small extent.

East of the Rocky mountains the plains are of the same character as those described for the route of the 38th and 39th parallels, uncultivable west of the 99th meridian. West of the first chain of these mountains the plains are covered with artemisia, rarely furnishing any grazing, except along the water-courses. The mountains, however, are generally covered, to a greater or less extent, with grass—the soil of those north, south, and west of the route between Fort Bridger and the headwaters of the Timpanogos river being of superior quality.

The absence of the geological report prevents my referring to the geological structure, which together with the climatological conditions, serve to corroborate or disprove opinions formed on appearances of sterility or fertility.

The indications given of the character of both, however, from the report, are sufficient to establish the general correctness of the opinions expressed.

ESTIMATE OF PROBABLE COST.

This estimate is made to show the probable relative cost of this route, as compared with others. That portion of it for the difficult and costly section of the Sacramento river, 136 miles in length, and for the cañon on the Timpanogos river, I have less confidence in than in the estimates generally. The estimate includes an equipment suitable for the first working of the road, about one-fifth that requisite for the development of its full power.

From Council Bluffs to the first gorge of the Black Hills, 520 miles, 25 per cent. being added to cost at eastern prices for one-half the distance, $35,000 per mile	$18,200,000
From the first gorge of the Black Hills to the summit of the South Pass, 291 miles, at $75,000 per mile, 50 per cent. having been added to cost at eastern prices	$21,825,000
From the South Pass to Fort Bridger, 131 miles, at $50,000 per mile, 50 per cent. having been added to cost at eastern prices	$6,550,000
From Fort Bridger to the Pacific, 100 per cent. has been added to the cost at eastern prices.	
From Fort Bridger, Green River valley, to foot of Oquirrh mountains, south end of the Great Salt lake, deducting ten miles for the length of the cañon on the Timpanogos river, 173 miles, at $60,000 per mile	$10,380,000

Ten miles of cañon on the Timpanogos river, at $150,000 per mile	$1,500,000
From the Oquirrh mountains, Great Salt lake, to the head of the first cañon on the Sacramento river, deducting ten miles of the length of the pass in the eastern ridge of the Sierra Nevada, and seventeen miles of the length of the pass in the western ridge of the Sierra Nevada, 547 miles, at $45,000 per mile	$24,615,000
Portion of the pass of the western ridge of the Sierra Nevada, seventeen miles, $100,000 per mile	$2,700,000
From the head of the first cañon on the Sacramento river to the termination of the mountain passage of the river, seventeen miles above Fort Reading, 135.5 miles, at $150,000 per mile	$20,325,000
Thence to Fort Reading, on the Sacramento river, seventeen miles, and thence to Benicia, 180 miles; being about 200 miles, at $50,000 per mile	$10,000,000
Total	$116,095,000

GENERAL REMARKS.

The characteristic features of this route consist in the table-land character of the two great mountain systems of the continent, the Rocky mountains and the Sierra Nevada, in the latitude where crossed by it, in the distance from the eastern foot of the Rocky mountains to the Great Basin (350 miles,) being the least, and in the width of the Great Basin, whose topographical features (those technically called *movements* of ground) are so highly favorable to the construction of a railroad, being here the greatest, 500 miles.

These elevated table-lands of the Rocky mountains and the Sierra Nevada bear some general resemblance, in their topographical features, independent of vegetation, to one of the elementary or small basins of the Great Basin; they are bounded on the east and west by ridges, whose crests are at no great height above the general plateau, but several thousand feet above the plains from which the mountain systems rise. In the Rocky mountain plateau, this difference of elevation is upwards of 4,000 feet; in the Sierra Nevada upwards of 3,000 feet on the east, the mountain slopes on the west descending to nearly the level of the sea. The Sierra Nevada assumes this table-land character again in latitude 35°.

The South Pass cannot be considered favorable, since it requires expensive construction for nearly 300 miles. The route by the Cheyenne Pass may be found more favorable, but there is not sufficient known of it to determine this.

The unfavorable feature of the passes in the Wahsatch mountains consists in their cañons, where the expense of construction will be great.

The two cañons of the Sacramento, fourteen and nine miles in length, and the very sinuous course of the river for the space of ninety-six miles, through heavily timbered mountains, rising precipitously from the stream, form the principal characteristic unfavorable features of the route, the cost of constructing a railroad along which cannot be properly estimated until minute surveys are made.

It partakes of the character of the route near the 47th parallel, in the long and severe winters on the plains east of the Rocky mountains and westward to the Great Basin.

The profiles compiled in the office show the route, near the 41st parallel, by the South fork of the Platte, the Cheyenne and Bridger's Pass. The estimate is made for the route by the South Pass.

SUPPLEMENT TO ROUTE NEAR THE FORTY-FIRST AND FORTY-SECOND PARALLELS; PREPARED BY LIEUTENANT G. K. WARREN, TOPOGRAPHICAL ENGINEERS.

The great South Pass, one of the key-points of this route, has in its character nothing of a mountain gap, being merely a depression in the line of intersection of two gently inclined plains sloping east and west. A few miles to the north of it commences the elevated range called the Wind River chain, (a portion of the Rocky mountains,) while an extensive table-land, dotted here and there with isolated hills, stretches away to the south. This elevated plateau is in latitude 42° north, and, viewed as a whole, may be said to extend east and west from the Black Hills to the Bear mountains; and from the Wind River mountains and Black Hills in the north, to the Park and Uinta mountains in the south, having a length from east to west of about 290 miles, and breadth north and south of 100 miles. Its general elevation is about 7,500 feet, though in portions it has been reduced to 6,000 feet by the action of streams.

The direction taken by the waters of its surface, divide this great plateau into three distinct parts,—one drained by the Laramie river, one by the North fork of the Platte and Sweet Water river, and the other by the Green river and other branches of the great Colorado of the west. The divides between each of these portions are slight, and such, perhaps, as have been produced by the action of the waters alone. Small lake basins exist in several parts, which contain only pools of brackish water, proving in themselves the dryness of the climate, since the accumulated waters have never been sufficient to force an outlet or form a continuous lake. The waters that traverse the other portions come mainly from the mountains.

The amount of snow that falls is not exactly known, but it must be small; and there is reason to think that, probably, the accumulations of the winter will rarely exceed one foot in depth.

During certain seasons of the year, (the spring,) parts of this plateau are well watered, and abound with buffalo and other game. Captain Stansbury saw abundant signs of the buffalo having been in immense numbers just west of Bridger's Pass; but at the time, (September,) they had all disappeared in search of water. He also encountered slight rains and fog in this vicinity; but the character of the soil was such as promised fertility, had there been a sufficiency of moisture, the absence of which is the *curse* of all this region. Excepting the immediate banks of the streams, some of which produce grass and trees of cotton-wood, willow, and aspen, it is one vast sage or artemisia desert. All reports concur in giving it this character.

The rocks and soil in the western part are soft and easily crumbled, and, under the action of its torrent-like streams during spring freshets, are much abraded and torn away; and the debris scattered over the bottoms have, in many cases, destroyed every particle of vegetation, and reduced these to the most perfect desolation.

The valley of the North fork of the Platte is narrow and well timbered with magnificent cotton-wood, but west of this Captain Stansbury says he saw nothing deserving the name of tree, only a few stunted cedars being found between the Platte and Green rivers, 175 miles.

The Wind River mountains are clothed with excellent pine and other trees, but the immediate hills on either side of the Sweet Water are naked. Wood is found in the Black Hills and Park mountains, (of the amount I cannot speak positively,) and also in the Bear, Wahsatch, and Uinta mountains.

Coal is found in quantity in various localities on branches of Green river; it is bituminous, and thought to belong to the oölitic period.* Captain Stansbury found seams of it ten feet in thickness, and he says the quantity is, apparently, unlimited. We have to regret, that after all the explorations in this belt of country, and after having so long been a highway to Oregon, Salt lake, and California, little is positively known about its geology.

Of the great section of country lying *east* of the extended plateau of which we have been speaking, and which, beginning at the foot of the Black Hills at an elevation of about 5,000 feet, reaches to the Mississippi, there is little to be said which is peculiar to the route under consideration. It has the same general features as in the other latitudes. In the eastern part it is a beautiful and fertile prairie, with wood upon the banks of the streams, and coal beneath its surface. As we go west it loses this character, and about the 99th and 100th meridians becomes, for the most part, dry and almost barren. The islands of the Platte are well wooded as far west as the 99th meridian. From the 100th meridian to the base of the Black Hills, it is in summer hot and arid, and the summer winds, in many places, as they come from the hills, seem to have just left a furnace. Wood and grass in this portion (250 miles) are very scarce.

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* See remarks of Professor James Hall, attached to Fremont's report, 1842-'3-'4, p. 298.

The favorite feature of the great section east of the mountains is the almost direct flow of the Platte and its branches from west to east, enabling us to obtain a location along the foot of the bluffs, which will give for the most a continuously ascending grade, and avoid the rolling country. Wood, water, and grass will also be found here more abundant than on the divides between the streams. This location, however, will no doubt involve much cutting and embankment, with frequent culverts.

There are two routes proposed for crossing the great plateau west of the Black Hills: one by the South Pass, in latitude 42° 20′, longitude 113°; and the other by Bridger's Pass, in latitude 41° 13′, longitude 110° 48′. If we begin at Council Bluffs, a route through either pass would have a common location in the valley of the Platte, to the junction of the North and South forks. Here they would separate; the one by the South Pass taking the North fork and Sweet Water, and the one by Bridger's Pass taking the South fork and Lodge Pole creek. The elevation at Council Bluffs is 1,300 feet; at the junction of the forks of the Platte, 2,900 feet; distance, 300 miles; average grade, 2 feet per mile.

As regards a connexion with Great Salt Lake City, the latter would be the more direct; but it is still a question as to which would be the better route for a railroad, though Captain Stansbury, who was over both, is positive in his preference for Bridger's Pass. Unfortunately he had no barometer or means of measuring elevations, and much is left to be inferred. The following facts concerning the two routes are extracted from Fremont's and Stansbury's reports:

By the South Pass.—The Platte river, 30 miles above Fort Laramie, and 220 miles above the junction of the forks, comes through a gorge with vertical walls, 200 to 400 feet high, formed by spurs from the Black Hills, and changes its character from a mountain stream to a river of the plains. Thence to the Red Buttes, 117 miles, there are numerous streams coming into the Platte from the Black Hills, which have made deep cuts in the earth near their mouths. The railroad would probably, through this portion, keep near the present wagon-road some miles to the south of the Platte, where the greatest obstruction Fremont found to his wagons was the strong growth of artemisia. A road along this section would be expensive, though the grades would probably not be difficult. At the gorge of the Red Buttes "the river is not much pent up, there being a bank of considerable though variable breadth on either side." A road could be located through this. Thence to the Hot Spring Gate, 34 miles, is an open valley. Above this point, the Platte is "exceedingly rugged and walled in by cañons." The road just below the Hot Spring Gate should turn off to the north, up the sandy bed of a dry creek to the summit of the Hills, the peaks of which are only 800 feet above the Platte; grade, 133 feet per mile for 6 miles. Then a gradual slope, 56 feet per mile, for 10 miles, conducts to the Sweet Water, at an elevation of about 5,640 feet; distance from Red Buttes, 50 miles. The Sweet Water occasionally cuts through spurs, making cañons, (that of the Devil's Gate being through granite;) but generally it is represented as rather open, and the immediate bottoms abound in soft grasses. The hills on either side are "rocky and bare." At one of the head-branches of the Sweet Water we reach the South Pass, (elevation 7,490 feet,) 124 miles from where we first struck the Sweet Water; average grade for the first 12 miles east of the summit, 22.5 feet, and the remaining 112 miles 14.7 feet per mile. The grades between these points would probably be somewhat undulating, but the present surveys do not afford the means of judging their extent. From the Red Buttes to the South Pass would be an expensive road, but it does not involve any difficult problem of engineering. Little need be apprehended from snows. The necessary fuel for working-parties could no doubt be obtained from the Platte, and ties from the Wind River chain, and excellent building-stone on the Sweet Water.

The sum of the known ascents to be overcome from Council Bluffs to the South Pass is 6,650 feet, including 460 feet at the Hot Spring Gate, to avoid which it was gained and lost.

The Bear River mountains, lying due west from the South Pass, forbid any direct passage in that direction. As yet, we know of no practicable way of reaching Salt lake but by Fort Bridger, through the pass explored by Lieut. Beckwith. This would carry us down the Sandy creek, a tributary of Green river, with coal in its banks, to the crossing of the latter stream: elevation 6,238 feet; distance 81 miles; average grade for the first four miles west of the South Pass, 70 feet; and for the remaining 77, 13 feet per mile. The width of Green river is here 400 feet, and the ford excellent, (Aug. 16, 1843.) No doubt exists as to the practicability of connecting with Lieut. Beckwith's survey in the neighborhood of Fort Bridger, elevation 7,254 feet; distance from Green river 50 miles: we thus have, from Council Bluffs to Fort Bridger, by the South Pass route, a total of ascents and descents of 9,386 feet, and a total distance of 943 miles.

By Bridger's Pass.—This proposed route is not so well known as the other. It keeps the South fork of the Platte (100 miles) to the mouth of Lodge Pole creek, which it is then proposed to take. This creek has never been continuously explored. Frémont crossed it near its mouth, and represents it as a clear, handsome stream, running through a broad valley, having a uniform width of 22 feet and depth of 6 inches, (July 6, 1842,) a few green willows on its banks forming a pleasing contrast to the surrounding barrenness. The timber appeared to have been formerly more abundant. He crossed this creek again, as near as he could ascertain from his "uncertain means of information," about 120 miles from its mouth, the elevation being about 4,800 feet: the banks were here about 700 feet above the stream; average slope about four feet per mile.

From this point to the Cheyenne Pass, in the Black Hills, is about 60 miles. The Black Hills act here much like the sustaining walls of a terrace, the plain at their east base being much lower than at the west. Capt. Stansbury says, speaking of this pass, that his "examinations fully demonstrate the existence of a route through the 'Black Hills' not only practicable, but free from any obstructions involving, in their removal, great or unusual expenditure."

The elevation of the east base of the mountains must be about 5,000 feet; the elevation of Laramie plain is 7,500 feet; the most favorable supposition is, that the pass is no higher. Not knowing in what distance this elevation is gained, it is impossible to speak of the grades. In crossing the divide between Laramie and Medicine Bow rivers, the elevation is given by Frémont at 7,994 feet; but there is such a confusion between Frémont's and Stansbury's maps, that its distance from the Cheyenne Pass cannot be ascertained. At the crossing, the North fork of the Platte has a width of 160 feet, depth 2 feet, (Sept. 6, 1850;) elevation, by Frémont, 6,820; distance from Cheyenne Pass, by Stansbury, 102 miles; thence to the summit of Bridger's Pass 30 miles. Capt. S. says the slope either way from the summit is so gentle as scarcely to be perceptible. In the table of distances we find it stated, that "the champaign country continues north to the Wind River mountains, and can be crossed in many places, the choice being determined by considerations of fuel and water."

It is altogether probable this pass does not differ much in elevation from the South Pass, and may be supposed the same, viz: 7,490 feet.

From the summit west the line descends Muddy creek a few miles, then crosses a rolling divide, (height not known,) between it and Bitter creek, both tributaries of Green river, and down the latter to Green river, elevation about 6,200 feet; distance from Bridger's Pass 135 miles; (the Green river is here 800 feet wide; the deepest water found, September 13, was 3 feet, but in high stages it is a formidable stream, and will have to be ferried;) thence to Fort Bridger, 50 miles. One important feature of this route, from the Cheyenne Pass to

Bridger's Fort, is the small amount of rock-cutting, and even that in very soft material. It, however, crosses ground much cut up by ravines and gullies, and many places easily torn up by the torrents, probably requiring great caution in location and much masonry, which the absence of good building-stone would render exceedingly expensive. An extensive embankment will be required on Muddy creek. It is probably very deficient in wood, for nowhere contiguous to it are large supplies reported to exist. Coal is abundant on the Green River section. From Council Bluffs to Fort Bridger, by this route, is 897 miles. If my reasoning as to elevations is correct, the sums of the ascents and descents are at least 12,082 feet. Applying the equation of grade, this would give an increased length of 229 miles—making the total equivalent horizontal distance 1,126 miles.

For the route by the South Pass we have, in the same way, an increased length of 178 miles, and an equivalent horizontal line 1,120 miles. I do not think it possible to make a correct comparison as to cost of constructing the two routes. It could only be done after careful examination on the ground with that object in view.

Should any route to Oregon be found practicable, leading along the foot of the Wind River mountains up the head-streams of Green river, and across the mountains between them and the headwaters of the Snake or Lewis river, the South Pass would gain additional importance as a point from which branches could be sent both to Salt lake and California, and to the Columbia.

There are reasons to believe that this latter route may be practicable; and it is, at least, worthy of a careful examination. The straight line from the South Pass to Fort Hall is 175 miles, while by the route surveyed by Frémont it is 444 miles, being the one usually travelled by emigrants. The known abundance of grass and water in the beautiful valley of Bear river has justified this great detour, to enjoy its plenty and repose, recruit the energies exhausted by the long journey already performed, and prepare for the desert of the Snake River valley. It is said by Mr. Lander, that the more direct northern route to Oregon is about to be opened for emigrants. If a feasible route be found between the headwaters of Green and Snake rivers, the exploration should be continued to Wallah-Wallah, as the passage of the Blue mountains is not yet demonstrated to be wholly practicable, either by the way of the Grande Ronde or the cañons of Snake river. The profiles will show the present emigrant route to Oregon, as surveyed by Frémont, and give all the facts necessary to be considered. Enough is there shown to demonstrate its impracticability for a railroad. The pass over the Bear River mountains might, however, be avoided by going south of Fort Bridger.

CHAPTER III.

ROUTE NEAR THE THIRTY-EIGHTH AND THIRTY-NINTH PARALLELS OF NORTH LATITUDE.

The general consideration that determined the position of the route to be examined near the 38th and 39th parallels of latitude, was its central position geographically—it being about midway between the northern and southern boundary lines of the United States—which is likewise the position, nearly, of the Bay of San Francisco, the two termini of the route, St. Louis and San Francisco, being respectively in latitudes 39° and 38°, nearly.

A route near these parallels would probably give the shortest road from the Bay of San Francisco to the navigable waters of the Mississippi.

But, since the only passes in the Sierra Nevada practicable for a railroad, yet made known, are found in latitudes 41° and 35°, this advantage of centrality of position is lost upon entering the Great Basin, in longitude 112° or 113°.

Neither do the features of the country, from and including the Rocky mountains to the Great Basin, favor the construction of a railroad along this line, recommended by considerations connected with its central geographical position, for the elevation of the two passes through the Rocky mountains, the Sangre de Cristo and Coo-che-to-pa, 9,200 feet and 10,000 feet, are the highest known practicable for a railroad, exceeding by 4,000 feet and 5,000 feet the highest mountain pass on the route near the 32d parallel, and by 3,000 feet and 4,000 feet the elevation of the passes on the route near the 47th parallel; and from the Rocky mountains westward to the Great Basin, 500 miles, the country is so broken, and the difficulties of construction so great, and the expense would be so enormous, that the building of a railroad over this portion may be pronounced impracticable.

In neither soil, climate, productions, nor population, nor from any other cause, does it possess advantages superior to other routes, favoring the construction and working of a railroad.

The concluding chapter of Lieutenant Beckwith's report upon the route from Westport to Sevier lake recapitulates so clearly and forcibly the characteristics of the country through which it passes, the nature of the soil, climate, and topographical features, the amount and quality of timber, fuel, stone, &c., with their bearing upon the construction and working of a railroad, that nothing remains to be added to it.

It appears that from the western frontier of the State of Missouri to the Sangre de Christo Pass, 650 miles, no *timber* suitable for railroad purposes will be found upon the route upon which reliance can be placed; that from the Coo-che-to-pa Pass to the Great Basin, more than 500 miles, there is no growth of timber on the route, and that such as exists in the mountains north and south of the line is too difficult of access to be available; nor is any to be found in the Great Basin on the route as far as followed towards Sevier lake, the nearest known supplies being in the mountains to the north, in latitude 40° or 41°. With building stone generally, it is, like the other routes, sufficiently well supplied. Of water, there is a sufficient supply on the whole route, except between Grand and Green rivers, a distance of 70 miles, over which at certain periods of the year it is probable little or none can be obtained.

The soil west of the meridian of 99° is, under the present meteorological conditions, uncultivable, except in limited portions of river bottoms and small mountain valleys; these latter, from their great elevation, being better adapted to grazing than agricultural purposes. This description is completely in accordance with the geological formation and meteorological condition, the former from the meridian of 99° west being apparently tertiary, excepting in the high mountain passes.

The great coal field of Missouri lies at the eastern extremity of the road, and could supply fuel on the route as far as the Rocky mountains—and still further west, should the coal formations on Grand river not yield an abundant supply. The existence of a seam one foot thick, though not sufficient for profitable working, is a good indication that others accompany it that would admit of mining.

In regard to grade and construction, it would appear that the Sangre de Cristo and Coo-che-to-pa passes are practicable; the latter with a tunnel nearly two miles long; their greatest grades are 103 and 124 feet per mile; their elevations are 9,200 and 10,000 feet above the sea, the general elevation of the mountain chains being 2,000 and 2,500 feet higher than this.

The construction of the road through the Coo-che-to-pa Pass and the western approach to it would be costly under favorable circumstances of population, &c., not only on account of the tunnel, but of the numerous ravines that are crossed west of the pass, and the cañon that follows.

From the head of the cañon on Grand river, not far below the mouth of Coo-che-to-pa creek, to the Uncompahgra river, a distance of 70 miles, the ground is cut up with deep, wide, precipitous ravines, (the largest several hundred feet deep,) over which the construction of a railroad is utterly impracticable. These ravines cannot be turned near the mountains without encountering similar difficulties, and at a cost greater than that of a route along the river.

Thus the route is forced upon Grand river, and along its cañon, 60 miles in length, broken and interrupted by the deep ravines already mentioned, and numerous smaller gulleys. The road-way throughout the greater part of this distance must be blasted out of solid rock, and these wide ravines, from 100 to 200 feet deep, where they cut through the cañon, crossed by viaducts or filling. Then follow 50 miles to the mouth of Blue river, the construction still of a difficult and costly character from the cañons of the river and broken nature of the ground. From Blue to Green river is 100 miles, over which the road will require numerous bridges and culverts, and a costly road-bed foundation of broken stone or piling over a clayey soil, in which, in wet weather, animals sink half-leg deep. From Green river to the Wahsatch Pass, about 80 miles, the construction would still be of a costly character, the country being of the same ravine and chasm-like nature as that between the mouth of Coo-che-to-pa creek and Uncompahgra river, though on a smaller scale. Next follows the Wahsatch Pass, the work in which is difficult and expensive; the greatest grade is 131 feet per mile; a tunnel not quite three-quarters of a mile long is requisite; and finally a cañon 16 miles long on Salt creek, the walls of which are frequently broken by lateral streams, gives the only route along which the road can be brought, by cutting in solid rock at very great expense.

The difficulties of engineering, and the cost of construction of this portion of the route from the Coochetopa Pass to Sevier river, in the Great Basin, a distance of about 500 miles, would be so great that it may be pronounced impracticable; and it is evident, from the report of Lieutenant Beckwith, that, to use his own language, "no other line exists in the immediate vicinity of this worthy of any attention in connexion with the construction of a railroad from the Mississippi river to the Great Basin."

It is unnecessary, therefore, to consider the route further, or to enter into any discussion connected with the probable practicability and cost of constructing and working a railroad over other portions of the route, where not one counterbalancing advantage is to be found to compensate, in any degree, for the enormous cost of that under consideration.

Laying aside the utter impracticability of this route, the following considerations will show its disadvantages as regards expenses of working, supposing it constructed.

From Westport to the west base of the Un-kuk-oo-ap mountains is 1,323 miles; sum of ascents, 23,190 feet; of descents, 19,050 feet; length of equivalent horizontal line for the route, 2,123 miles.

Of the direct route from the point at the western base of the Un-kuk-oo-ap mountains—elevation 5,131 feet, distance from Westport 1,323 miles, where the survey under Captain Gunnison terminated—to the Tay-ee-chay-pah Pass, there is no positive information or survey. Colonel Frémont says, page 270 of his report for 1842, '43, '44, that from the time he descended from Walker's Pass and began "to skirt" the desert, till he reached the vegas of Santa Clara, "*he had travelled* 550 *miles, occupying* 27 *days in that inhospitable region;*" and that "*in passing before the great caravan, he had the advantage of finding more grass,*" &c. And again, he speaks of the journey as "a month's suffering in the hot and sterile desert." This, in connexion with Colonel Frémont's description of other parts of the Great Basin, gives every reason to believe that from Sevier lake to the Tay-ee-chay-pah Pass it is, for the most part, a desert of the same general character as other portions of the Great Basin. Supposing the route to be a straight line, with uniform descent from the Un-kuk-oo-ap mountains to the entrance of the Tay-ee-chay-pah Pass, in latitude 35° 7′, (no pass being known to be practicable to the north of it, in this portion of the Sierra Nevada,) the distance will be 430 miles, and the descent 1,830 feet; the equated horizontal distance, 464 miles.

From the entrance of the Tay-ee-chay-pah Pass to San Francisco is 326 miles; sum of ascents, 1,308 feet; sum of descents, 4,608 feet; equated length, 438 miles. Adding these together with the equated distance from the mouth of the Kansas to the west base of Un-kuk-oo-ap mountains, we have the total equated distance from Westport to San Francisco—3,025 miles; the length of the straight horizontal line, which supposes no obstacle to be avoided, being only 1,500 miles.

The straight line from St. Louis to San Francisco is 1,740 miles long; it crosses the Rocky mountains in about latitude 39° 13′, the Wahsatch in about latitude 39°, the Sierra Nevada in about latitude 38° 6′; it is 110 miles north of the Sandy Hill Pass, 75 miles north of Coo-che-to-pa, and about coincides with the north bend of Grand river; is 20 miles north of the Wahsatch Gap, and 225 miles north of Tay-ee-chay-pah Pass.

From the Sevier river a practicable connection can be made with the route surveyed by Lieut. Beckwith, near the forty-first parallel, through the Great Basin.

The distance from Sevier river, at the crossing of the Mormon road to Salt lake, is 120 miles, sum of ascents and descents 1,600 feet, and equated distance 150 miles; thence to Benicia is 872 miles, sum of ascents and descents 15,200 feet, and equated distance 1,160 miles; from Westport to Sevier river 1,298 miles, the sum of the ascents and descents are 39,714 feet, and equated distance 2,050 miles. Taking the sum of these three portions, we have from Westport to Benicia, via Coo-che-to-pa Pass, Great Salt lake, and Madelin Pass, a distance of 2,290 miles, sum of ascents and descents of 56,514 feet, and an equated distance of 3,360 miles.

NOTE.—This line could, perhaps, be considerably shortened by taking a direct route from Sevier river to the pass of the Humboldt mountains; but it has not been explored. The straight-line distance between these points is 200 miles, while by the route surveyed it is 280 miles.

CHAPTER IV.

ROUTE NEAR THE THIRTY-FIFTH PARALLEL OF NORTH LATITUDE.

The report of Lieut. Whipple upon the route explored by him, near the thirty-fifth parallel of latitude, with its accompanying sub-reports, being brief, it is unnecessary to recapitulate the details given in them. Some remarks upon the general direction of the route, and upon the points which characterize it, and in which it differs from that of the thirty-second parallel, may be necessary.

From the general description that follows, it will be seen that the features of the ground which have determined the direction of the route are the extension west and east of the interlocking tributaries of the Mississippi, the Rio Grande, and the Colorado of the West.

The route may be said to commence at Fort Smith, on the Arkansas, in about longitude 94° 26′, latitude 35° 23′; elevation above the sea 460 feet; the connexions of which point with Little Rock, Memphis, St. Louis, and other centres of trade, are clearly stated. From Little Rock to the Antelope Hills, on the Canadian, elevation 2,100 feet, in about longitude 100°, a distance of near 400 miles, the route may follow either the valleys of the Arkansas and Canadian, or a shorter line, perhaps, but over more broken ground south of the Canadian—this latter route branching again and following either the valley of the Washita, or the dividing ridge between it and the Canadian.

From the Antelope Hills the route continues along the bottom of the Canadian, on the right bank, to the mouth of Tecumcari creek, about 250 miles, and ascends by the valley of Tecumcari, or by that of Pajarito creek, to the dividing ridge between the Canadian and the Pecos rivers, elevation about 5,543 feet, and enters the valley of the latter. It follows this valley until, by means of a tributary, it rises to the high table-land, or basin, lying east of the Rocky mountains, elevation about 7,000 feet, crosses the elevated Salinas basin, 30 miles wide, the lowest point being 6,471 feet, and gains the divide in the Rocky mountains, elevation about 7,000 feet; from which point it descends to Albuquerque, or Isleta, on the Rio Grande, through the San Pedro Pass; or it may descend to the Rio Grande by the valley of the Galisteo river, north of Sandia mountain. A third route is indicated along the valley of the Pecos to its headwaters; thence to an affluent of the Galisteo; and thence, as before, to the Rio Grande.

Isleta, on the Rio Grande, is 854 miles from Fort Smith, and 4,945 feet above the sea.

Crossing the ridge separating the Rio Grande from the Puerco, the route follows the valley of its tributary, the San José, to one of its sources in a pass of the Sierra Madre, called the Camino del Obispo. At the summit (elevation 8,250 feet) a tunnel three-fourths of a mile long, at an elevation not less than 8,000 feet, is required, when the descent is made to the Zuñi river and near the Pueblo of Zuñi; the route then crosses over undulating ground to the Puerco of the West, at the Navajo spring. Another route across the Sierra Madre, about 20 miles further north, was examined by Mr. Campbell, which is, apparently, far more favorable. The profile is not from reliable instrumental examination. The height of the summit is about 7,750 feet above the sea. The Puerco of the West heads in this pass, and the route follows the valley of this stream to its junction with the Colorado Chiquito, then the valley of that stream to the foot of the southeastern slopes of the San Francisco mountains, (elevation 4,775 feet;) distance from Fort Smith 1,182 miles, and from the crossing of the Rio Grande 328 miles. Here it ascends to the dividing ridge between the waters of the Gila on the south, and of the Colorado of the West on the north, and continues (or nearly so) upon it for about 200 miles, to the Aztec Pass, (elevation 6,281 feet;) distance from Fort Smith 1,350 miles. The highest point reached upon this undulating ridge is 7,472 feet at Leroux's spring, at the foot of the San Francisco mountain. From the Aztec Pass the descent to the Colorado of the West is made by a circuitous route northward along valleys of its tributaries, the largest and last being Bill Williams fork, the mouth of which, on the Colorado, is 1,522 miles from Fort Smith, and at an elevation above the sea of about 208 feet.

The Colorado is now ascended thirty-four miles, the route leaving it at the Needles. The supposed mouth of the Mojave river was examined: by the valley of this stream it was expected to ascend to the Cajon Pass in the Sierra Nevada. This proved, however, to be the valley of a stream, dry at the time, whose source was in an elevated ridge which, probably, divides the Great Basin from the waters of the Colorado. It is not yet ascertained that the valley of the Mohave river is continuous to the Colorado, though Lieutenant Whipple is sanguine that it will be found to be so. From the summit, 5,262 feet (cut thirty feet) above the sea, the descent is made to Soda lake, the recipient, at some seasons, of the waters of the Mohave river, 1,117 feet above the sea, at an average grade of 100 feet to the mile for forty-one miles, the steepest grade yet required on this route. The ascent to the summit of the tunnel, elevation 4,179 feet, in the Cajon Pass in the Sierra Nevada, is made by following the valley of the Mojave river. The summit of this pass, by the line of location, is 1,798 miles from Fort Smith, and 242 from the point of crossing the Colorado. Here, according to Lieutenant Whipple, a tunnel of 2½ miles, through white conglomerated sandstone, is required. But, according to Lieutenant Williamson, who spent more time upon it, it would be $3\frac{4}{15}$ miles. The tunnel descends to the west with an inclination of 100 feet per mile, which grade will be the average for twenty-two miles, into the valley of Los Angeles, by side location, and thence to the port of San Pedro, 1,892 miles distant from Fort Smith.

Lieutenant Williamson reports upon the Cajon Pass, that, in his opinion, the natural grades, varying between 90 and 171 feet per mile, cannot be much reduced by side-location, on account of the broken character of the hills.

Should it be desired to reach San Francisco by the Tulares and San Joaquin valleys, the route should leave the Mojave valley some thirty miles before reaching the entrance to the Cajon Pass, 1,768 miles from Fort Smith, elevation about 2,555 feet, and proceed across the southwest corner of the Great Basin, towards the Tah-ee-chay-pah Pass, reaching its entrance at an elevation of 3,300 feet, in a distance of about eighty miles, and without crossing ridges that would increase the ascents more than 500 feet beyond the difference of elevation of the two points. The route is then coincident with that described for the 32d parallel.

The general features of the country indicated lines for examination at more than one point, which will, probably, greatly improve the route by reducing the ascents and shortening distances. The party was, however, unable to examine them.

An examination of the profile of this route shows that, in respect to grade, it is not only practicable, but that the heaviest grades that will probably be required do not equal those in use on the Baltimore and Ohio railroad.

SOIL.

Grama grass being found on the north bank of the Canadian, in longitude 96°, and extending westward in greater or less abundance to the Sierra Nevada, indicates that the change from fertility to barrenness begins in that longitude, at least north of the Canadian. Cacteæ also make their appearance with grama grass. South of it, however, the geological formation is that of a good soil to about longitude 98½. At this point the change to uncultivable land is complete, excepting in the river-bottoms, which are more or less fertile, but not the great body of the land. Not far south of the route good soil extends westward to the termination of the Witchita mountains. Some portions of the upper valley of the Canadian, the upper valley of the Pecos, the valleys of the Rio Grande, Zuñi, Colorado Chiquito, San Francisco, Colorado of the West, and its tributaries, possess a fertile soil, requiring, generally, irrigation to make it productive. That portion of the southwest corner of the Great Basin traversed by this route, and over which the explorations of Lieutenant Williamson extended, is well constituted for fertility, its barrenness resulting from the absence of rain. Generally the uncultivable plains have an abundance of nutritious grass, though there are extensive tracts where little or none is found—the two greatest being from the Antelope Hills to Tecumcari creek on the Canadian, 250 or 260 miles, and from the lower part of Santa Maria river to the Mohave river, 200 miles.

The country north of the Colorado Chiquito and west of the Sierra Madre as far as the eastern slope of the San Francisco mountain, is represented to be a remarkably fine grazing country; from that point westward to about the meridian of 113½° (sixty or seventy miles east of the Colorado,) it is well wooded, the whole presenting an attractive appearance to the traveller, who would, no doubt, from its strong contrast to other portions, describe it as a highly fertile region, though, with the exception of the valleys of the streams, it would prove upon trial to be uncultivable.

The land now cultivated in New Mexico is estimated at 200 square miles, and the land cultivable now vacant, exclusive of the vast region occupied by the Navajoes, Moquis, Tanians, and wilder tribes of Indians, at about 490 square miles, giving a total of about 700 square miles.

Only one-fifth of the bottom land of the Rio Grande capable of irrigation and cultivation, is now under culture.

The valley of the Colorado between its mouth and the 35th parallel, contains 1,600 square miles of fertile soil capable of irrigation.

BUILDING MATERIALS, TIES, LUMBER, &C.

The geologist, Mr. Marcou, describes the Trias and Jurassic formations, extending from Delaware mountain on the Canadian, to the Rocky mountains, 600 miles, as generally soft and friable; but as Lieutenant Whipple, and Mr. Campbell, the assistant railroad engineer, report the existence in these formations of good sandstones, suitable for the bridge-building required, this portion of the route may be considered well supplied with good building-stone. Over other portions of the route it would be found at intervals not too great for economical transportation.

TIES, LUMBER, &C.

Timber of size suitable for ties, and lumber generally for railroad uses in large quantities, is found in the following localities: Continuously on the route east of longitude 97°; in or near the Pecos valley; in the Rocky mountains and Sierra Madre; in the Mogoyon mountains, (south of the route) in which the Colorado Chiquito and some of its tributaries rise; on the slopes of the San Francisco mountain, and continuously with short intervals for more than 120 miles, and on the Sierra Nevada. The distances apart of these points of supply are, respectively, 540 miles, 100 miles, 150 miles; from the Sierra Madre to San Francisco mountain, 250 miles; then for a space of about 120 miles the supply may be considered continuous; thence to the Sierra Nevada, 420 miles. The road being built from the two termini, the greatest spaces over which ties, lumber, &c., must be brought by it, are 400 and 500 miles. The route, therefore, in comparison with others, is favorably circumstanced in this respect.

FUEL.

From longitude 97° to the Pecos valley, 540 miles, there will probably be sufficient fuel for working parties, and perhaps for 200 miles of this distance sufficient for railroad use might be found, but not for the remaining 350 miles. Between the Pecos and the Rocky mountains, 100 miles; across the valley of the Rio Grande, 150 miles; from the Sierra Madre to San Francisco mountain, 250 miles, sufficient fuel for working parties will probably be found without excessive cost. As it can be brought from the Mogoyon mountains to various points on the Colorado Chiquito, and exists at the extremities of these spaces, this portion of the route may be considered amply provided with fuel. Over the space of 120 miles from San Francisco mountain to the Aztec Pass, a sufficiency for railroad purposes will be found at convenient distances. From the Aztec Pass to the Sierra Nevada, 420 miles, no fuel for railroad purposes will be found, and that for working-parties will be scanty in some places. From the point of leaving the Colorado to the Mohave river, 115 miles, no fuel is to be had.

It is reported that coal exists in several localities in the Rocky mountains, both east and west of the Rio Grande, near this route, but there is no positive and reliable information that it has been found in sufficient quantities for profitable mining.

As coal for locomotive uses will bear transportation 3.5 times as far as wood, the supplies of fuel for the 350 miles east of the Rio Grande can be had from the coal-fields of Delaware mountain; that for the space of 540 miles east of the Sierra Nevada, from the Pacific ports, the mean distance to which it must be transported in the latter case being 260 or 270 miles. These are the only two portions of the route which cannot be readily supplied from convenient distances on the route.

Fuel forms about one-fifth the yearly expense of maintaining and working a railroad.

WATER.

The exact distances over which water is not found at certain seasons, or permanently, are not stated. It does not appear, however, that a resort to unusual means will be necessary east of 100° longitude. Between that and the Pacific there are spaces destitute of it, where, from the known character of the geological structure, there is no doubt that sufficient supplies can be obtained either by deep common wells, artesian wells, or reservoirs. It is better supplied with water than the route of the 32d parallel, and from the Rio Grande to Santa Maria river there are supplies of timber and fuel on the line, which the other route is deficient in. These larger supplies of timber and water west of the Rio Grande are attained at the expense of great elevation and somewhat rugged ground.

The Galesteo Pass in the rocky mountains and the passes in the Sierre Madre being wide openings, or valleys, rather than mountain passes, no difficulty need be apprehended from snows, even if it fell to greater depths than those known. Over the remainder of the route no difficulty from this cause is to be met with.

ELEVATIONS, &C.

The line rises gradually from the eastern terminus, and on Pajarito creek, 705 miles from Fort Smith, has attained an elevation of 5,000 feet above the sea, which elevation it does not descend to again (except for a short distance) for a space of over 600 miles, and until on the descent to the Colorado of the West. It passes the Rocky mountains at an elevation of 7,000 feet, the Sierra Madre at 8,000 feet, the foot of San Francisco mountain at 7,450 feet, the Aztec Pass at about 6,000 feet, the divide between the Great Basin and the Colorado at 5,300 feet, and the Cajon Pass by a tunnel 4,000 feet above the sea.

The sum of the ascents from San Pedro to Fort Smith is 24,641 feet, of descents 24,171 feet—equivalent, in the cost of working the road, to an increased horizontal distance of 924, which added to the length of the line of location, 1,892 miles, gives for length of equated distance 2,816 miles.

The sum of ascents from San Francisco to Fort Smith by the route from Mohave river to Tah-ee-chay-pah Pass is 25,570 feet, of descents 25,100 feet; the equivalent in miles of horizontal road is 963 miles, which added to the location distance between these two points, 2,174 miles, gives for equated length of road 3,137 miles.

ESTIMATE.

The description of the topographical features of the route is not sufficiently minute to enable one to form a satisfactory opinion of the difficulties of ground to be encountered, and consequently of the probable cost of the formation of the road-bed. Upon this point we must rest satisfied with the opinion of Lieutenant Whipple, who assimilates the several portions of the route to roads already built possessing as nearly as possible similar features and difficulties. The impression, however, conveyed by the report, as to the nature of the ground passed over, together with that formed from the description by others of some portions of it, induced me to think that the ground was more favorable than the comparison of Lieutenant Whipple shows it to be, and that the amount of work in forming the road-bed would have been less than that of the roads mentioned.

Four hundred and eighty miles of the route are assimilated to the Hudson River railroad; 151 miles to the Worcester and Albany railroad, (Western railroad;) and 374 miles to the Baltimore and Ohio railroad; making 1,005 miles assimilated to railroads among the most difficult and costly that have been constructed in the United States.

It is probable that, from the Rio Grande to the Colorado, the additional cost to eastern prices should have been rather 100 per cent., than 40, 50, and 60 per cent.—the increased cost allowed by Lieutenant Whipple. For the remaining distance, from the Colorado to the Pacific, 100 per cent. has been added by Lieutenant Whipple to the cost at eastern prices. This estimate includes the cost of equipment. This, on the roads used as standards of comparison, amounts to $6,000 or $7,000 per mile, four-fifths of which should be deducted, as the cost per mile from this source may be one-fifth of the cost on the eastern roads. This would diminish the estimate about $12,000,000, but at the same time the increased per-centage would increase it about $19,381,000. The difference between these sums, $7,381,000, (about,) should be added to the corrected estimate, $161,829,265, and the total estimate under this supposition becomes $169,210,265.

CHAPTER V.

ROUTE NEAR THE THIRTY-SECOND PARALLEL OF NORTH LATITUDE.

As the information respecting this route is to be found in several separate reports, and as those upon that portion of it between the Rio Grande and the Pacific ocean do not discuss the railroad practicability and mode of construction with the minuteness necessary, and as there is no railroad report upon the whole route, I have been obliged to enter minutely into details which, on the other routes, are found in the reports of the exploring officer.

1. FROM FULTON TO THE RIO GRANDE.

The report of Captain Pope is methodically arranged; and being brief, yet sufficiently full, it is unnecessary to make a synopsis of it. The portion of the route near the thirty-second parallel examined by him is that from the Red river to the Rio Grande, a distance of 646 miles. It is naturally divided into three distinct belts, which are clearly described by Captain Pope.

The first division, from the Red river to the eastern border of the Llano Estacado, 352 miles, gives generally easy grades, except where, in crossing streams, we have probably to descend from the bluffs to near the level of the stream, and ascend again; but which can be reduced, by lengthening the line, to the grade found suitable to the other portions of the route. This part of his line has an abundant supply of water and fuel, of wood for cross-ties, and lumber for two-thirds of the distance.

The important characteristic feature of Captain Pope's route, dwelt upon with so much force by him, is the extension westward of fertile land to near the headwaters of the Colorado. It is to be remarked that, from the geological indications, it is probable that a line drawn from Red river at the termination of the fertile soil, *in its basin*, in a general parallel direction with the Gulf coast, from the mouth of the Sabine to the Nueces river, will mark the boundary between the cultivable and barren soil. The influence of the moist winds of the Gulf of Mexico may also aid in giving this westward extension to the fertile land near the parallels of 32° and 34°. North of the Canadian, this boundary line between fertility and barrenness takes the direction of the meridian, and extends along it northward into the British possessions.

The evidence adduced in support of this western extension of fertile soil is not sufficiently full or conclusive.

The specimens of soils, of which the analysis is given, were gathered from the Upper Cross Timbers westward; but it is not stated whether those which belong to the section, from that point to the Llano Estacado, were intended to represent the condition of the most fertile portions, or the average condition of the whole surface.

Even if their analysis exhibited fertile constituents, it is well known that many extensive areas of tertiary soil well constituted for fertility are uncultivable, from the meteorological conditions of the district in which they are found. Additional facts are, in my opinion, required to establish the existence of the westwardly extension of fertile soil in this latitude.

The second belt described is the Llano Estacado, 125 miles across. Upon this it is only necessary to remark, that its geological formation is such as to render the success of artesian wells, in obtaining large supplies of water, certain. To build a railroad across it, commencing at the eastern border, at the last point of abundant supply of water, parties should be pushed forward to dig tanks wherever the ground favors their construction, and to sink artesian wells at distances of 20 miles apart, or less, should water be readily procured by this process. Supposing it even necessary to bore an artesian well at every 10 miles, and that the cost should be $10,000 each well, which is double that of an excessive estimate of the cost of a series of these wells, we should have $1,000 per mile for cost of road from this cause. By these two means, abundant supplies of water can be got at points a few miles apart, where the camps of the working parties, which need not be large, can be established. The dwarf mezquite, found on the Llano, will furnish sufficient fuel for these parties.

Railroad trains having engines of twenty-two tons, on four drivers, can carry sufficient water from the headwaters of the Colorado to the mouth of Delaware creek or the Pecos, 125 miles, without adding to the expense of running the trains; and can, from either end of this line, supply all the intermediate stations necessary for the superintendence, repair, and supply of the road.

Ties can be brought from the country east, and from the Guadalupe mountains, at reasonable cost. Fuel, also, can be supplied from the Brazos, or from the Colorado of Texas. Fortunately, over these plains, destitute of water, but very little excavation or embankment will be required, and the rails can soon be laid. Probably it would be most convenient to bring ties, sleepers, and lumber generally, by the road itself, from the route east of the Llano. In fact, from the east border of the Llano westward, and from the Pacific eastward, a distance of 1,200 miles, the road must be made, as it were, to build itself, carrying its lumber, iron, rails, provisions, and sometimes water, so far as a proper adjustment of economy of time with that of expenditure admits of its doing so. Its progress, from this cause, will be slow; but as the surface is very smooth, and the inclinations gentle, over these plains, its construction will be proportionately more rapid, aiding to balance the slow progress from the other cause.

The third section, from the Pecos river to the Rio Grande, presents no unusual difficulties in grade or construction, so far as dependent upon the topographical features of the country. The Guadalupe mountains are passed without a tunnel, and with a grade of 108 feet to the mile; a grade not exceeding those found on roads now built, as on the Baltimore and Ohio, and other railroads. Other routes through or around these mountains are recommended for examination, which, it is thought, will give easier grades. Sufficient supplies of water can be had at convenient distances apart, fuel for working parties from the dwarf mezquite on the plains, and cross-ties and lumber can be had from the Guadalupe mountains immediately on the line of the road, and from the Waco mountains, 30 miles distant from it, and also by means of the built portions of the road, from the supplies on the Brazos and Red rivers.

BUILDING-STONE, &C.

In regard to good building-stone the report of the geologist, Jules Marcou, on the specimens procured by Captain Pope—see Chapter 13, Captain Pope's Report—is not sufficiently explicit respecting all the formations. The cretaceous from Red river to the lower line of the Upper Cross Timbers, 70 miles, is probably too soft; but thence to the Clear fork of the Brazos, 120 miles, it is undoubtedly good. From the Clear fork to the Guadalupe mountains, 340 miles, the route is over formations called by the geologist Trias and Jurassic. From his description it is possible they may be found too soft, though good building-stone is found in the Trias, as, for instance, the new red sandstone of the Connecticut. The geologist says: "For the construction of a railroad the rocks of the Trias present great facilities. They furnish sandstone, plaster or gypsum, excellent hydraulic lime from the magnesian limestone, and, finally, they are very easy to work, and at the same time firm enough to form excavations or embankments." The sentence is somewhat inexact in its language. The detailed geological report will remove any uncertainty upon this point. Lieutenant Whipple passed over the same formations on the route of the 35th parallel, and, with the assistant railroad engineer, reports the existence of good building-stone there. From the Guadalupe mountains to the Rio Grande excellent building-stone is found.

The existence of coal upon the Brazos is of importance to this route. Fuel for working the road, as well as lumber, will be considered separately for the whole route.

In general it may be remarked on this section of the route near the 32d parallel, from the Red river to the Rio Grande, 780 miles, that the topographical features of the ground present no unusual difficulties and many favorable circumstances; that supplies of building material can be obtained throughout the line without excessive cost; and that the supply of fuel and water, throughout those portions destitute of it, can be had without greatly increasing the cost of construction and transportation.

The elevations are:

From Preston, on Red river, 641 feet above the level of the sea, the ground rises in six miles to the level of about	1,200 feet.
At the Upper Cross Timbers	1,782 feet.
At the West fork of Trinity	1,524 feet.
At the Brazos river	1,700 feet.
At the divide of the Brazos and Colorado rivers	4,237 feet.
At the Colorado	3,969 feet.
At the border of the Llano Estacado	4,278 feet.
The greatest elevation of the Llano Estacado is	4,707 feet.
The general elevation of the Llano Estacado is about	4,500 feet.
The elevation of the Pecos, where crossed	4,070 feet.
The elevation of the summit of the Guadalupe Pass	5,717 feet.
The elevation of the summit of the Hueco Pass	4,812 feet.
The general elevation of the table-lands between the Pecos and the Rio Grande, is from	4,000 to 4,500 feet.
The elevation of the Rio Grande valley, at Molino, is	3,830 feet.

ESTIMATE.

The estimate for cost of construction is, perhaps, in excess; the cost per mile from Fulton, on Red river, to the Rio Grande, a distance of 780 miles, being at the rate of $50,000 per mile. On the northern route, the estimated mean cost of the first 780 miles is about $35,400 per mile, (240 miles at $25,000 per mile—next, 712 miles at $40,000 per mile;) yet, from the description of these portions of the two routes, it is evident the difference in cost per mile of constructing the two will not be great. This is mentioned to show what different judgments are formed in making these estimates, and what caution should be used in being guided by estimates in figures of the costs of routes that have not been subjected to the same judgment or same standard. The difference of estimated cost in this distance of 780 miles on roads that would not probably vary greatly in their actual cost of construction, is $11,700,000; and if the same difference should exist throughout the entire distance, it would sum up to about $35,000,000.

2. FROM THE RIO GRANDE TO THE MOUTH OF THE GILA.

After ascending from the bottom lands of the Rio Grande, in traversing the region examined by Lieutenant Parke between these two rivers, from Doña Ana to the Pimas villages, one appears to be travelling on a great plain, interrupted irregularly and confusedly by bare, rugged, abrupt, isolated mountain masses, or short ranges, seemingly, though not in reality, without system. Winding around these isolated or lost mountains, or using a few passes through them, a railroad may be constructed with easy grades. The instrumental profile, however, shows that what to the eye appears to be a plain, is really an undulating surface, constantly rising and falling, rarely horizontal, and that the plain is converted into a series of basins, the steepest parts of which are found in passing around the lost mountains, or through the passes in them. The summits of these basin-rims or passes are generally about 400 feet above the lowest parts of the basins, though in two instances 850 and 1,200 feet respectively; the mean elevation of the basins above the level of the sea being about 4,100 feet, decreasing from near the Rio Grande, where it is 4,350 feet, towards the Gila. The mean elevation of the lowest points of the dividing rims is 4,700 feet, the highest of them, the pass through the Chiricahui range, being 5,180 feet. Seven basins are crossed, the eighth continuing or conducting to the Gila. Except through the mountain passes, the surface is so smooth as to require but little preparation to receive the superstructure of a railroad; and even in the two most difficult of the passes, (where, in one case, deep cutting or a tunnel at the summit, near the surface, in rock, with heavy side-cutting and high embankments for short distances, and in the other a short cut of 60 feet—probably through rock—are proposed by Lieutenant Parke, to attain grades of 46 feet and 90 feet per mile, or less by increasing distance,) the natural slope of the ground may be used for a railroad for temporary purposes, and until the road itself can reduce the cost of materials and supplies to the lowest rates.

The following table of distances and grades over the natural slopes, is given to show this. These two most difficult parts of the road are from 25 to 30 miles apart. In the Chiricahui Pass, the steepest natural slope is 194 feet to the mile for a distance of 2¼ miles. A twenty-four ton engine, on six drivers, can carry a load of 76 tons (200 passengers with 100 pounds baggage each) up a grade of 221 feet to a mile in the worst condition of the rail.

In the pass through the ridge east of the Valle de Sanz, the steepest natural slope is 240 feet to the mile for a distance of three-quarters of a mile. A thirty-ton engine, on six drivers, will carry a load of 76 tons (200 passengers with 100 pounds baggage each) up a grade of 281 feet per mile. But the tunnel of three-quarters of a mile through rock near the surface, or cutting, may be preferable to using this steep slope. This natural slope of 240 feet to the mile for the distance of three-quarters of a mile, may be reduced to one of 200 feet to the mile, by a short cutting of 30 feet depth. The natural slope in the steepest part of the Chiricahui Pass being nearly 200 feet to the mile, this cut would reduce these two passes to the same condition. These two points have been referred to not as presenting very great difficulties in construction, but merely from their being the only points on the line that appear to require any excavation and embankment, except of a trifling kind, to obtain grades generally in use on railroads, and to show that even here the natural slopes were such as might be used with but little preparation for the superstructure.

It is probable that further examination will show that the pass of Puerto del Dado may be avoided by passing to the north of the Chiricahui mountains.

The elevation of the camp near Fort Fillmore is 3,938 feet above the sea. The river between this and El Paso is about 300 yards wide when confined to one channel, and presents no serious difficulty to bridging. The elevation at Molino, the terminus of Captain Pope's survey, is 3,830 feet; the distance between them 32 or 35 miles.

Parke's grades.

From the Gila, 10 miles,	28.6 feet per mile,	ascending.	
60 "	7	"	"
12 "	23	"	"
19 "	50	"	"
3 "	level.		

18	miles,	38	feet per mile	ascending.
6½	"	61	feet per mile,	descending.
6½	"	level.		
16½	"	62	feet per mile,	ascending.
8½	"	54	feet per mile,	descending.
5	"	level.		

In the Puerto del Dado of the Chiricahui range, instead of the 60 feet cutting, heavy embankment, and side-cutting, and the grades used by Lieut. Parke, 46 feet the greatest, we may use temporarily the surface grades, which are as follows:

21½	miles,	48	feet per mile,	ascending.
0.65	"	180	"	"
2¼	"	194	feet per mile,	descending.
3½	"	94	"	"
6	"	19	"	"
14	"	23	"	"

In the gap in the ridge east of the Valle de Sauz, instead of the cutting of 60 feet, or tunnelling, and a grade of 90 feet, or less, by increasing distance, we may use, temporarily, the surface grades, which are as follows:

Camp 24, to station 1.—	1.55	mile,	150	feet per mile,	ascending.
	2.45	miles,	104	"	"
	0.7	mile,	240	"	"
	0.5	"	30	feet per mile,	descending.
	2.25	miles,	57	"	"
Station 6..................	1.45	miles,	72	"	"
	4	"	21	"	"
	3	"	4	feet per mile,	ascending.
	5.5	"	75	"	"
	8	"	46	feet per mile,	descending.
B.....................	16.5	"	51	feet per mile,	ascending.
	11	"	level.		
	34	"	25	feet per mile,	descending.
	11	"	11	feet per mile,	ascending.
	12	"	5	feet per mile,	descending.
	4½	"	44	feet per mile,	ascending.
	11½	"	22	feet per mile,	descending.
	3	"	123	"	"

WATER AND FUEL.

This region, then, presents great advantages in the construction of a railroad at small cost, so far as the grading and preparing the road-bed for the superstructure is concerned; but in two elements for cheap construction and working of a road, it is now very deficient, viz: water and fuel. For the first, the distances apart of the permanent streams affording large supplies, in the dryest season of the year, and therefore under the most unfavorable circumstances, are as follows:

From the Rio Grande to the Rio Mimbres, 71 miles.

From the Rio Grande to Cook's Spring, 61 miles, it being 53 miles from the Rio Grande, and 8 miles north of the track.

From the Rio Mimbres to the Rio San Pedro, 152.5 miles.

Intermediate is Valle de Sauz, 72 miles, where water is always found; 25 miles further on, is a spring in the Puerto del Dado.

From the San Pedro to Tuczon, 53 miles.

From Tuczon to the Gila, 79 miles.

There are springs between some of these points which it is not necessary to particularize.

For the working of a railroad after construction, the greatest even of these distances, 152.5 miles, is not too great to be overcome by special arrangements. But for the working parties engaged in building the road, supplies of water must be had at every few miles. Fortunately, the formation of these basins is such as to afford, at comparatively small cost, sufficient supplies of water at distances convenient for the construction of the road. During certain portions of the year, the bottoms of some of these basins are converted into lakes, which may be drained into tanks.

The following description of these basins by Dr. C. C. Parry, geologist upon the Mexican boundary survey, shows that artesian wells, of no great depth, can be resorted to successfully:

"All the so-called '*mesa formations*' and '*jornadas*' of this district belong to a distinct system of basin deposites, tertiary, or post-tertiary, in age, and still showing in outlines of greater or less extent the original areas in which these depositions were made. These basins exhibit, quite uniformly, central depressions, and margins gently rising to the limit of the mountain boundaries. The '*mesa*,' or table-land character, is exhibited only along the line of river-valleys, as high bluffs, the result of denuding forces subsequent to the original basin depositions.

"These deposites are characterized, as a whole, by a great preponderance of porous materials, consisting of gravel, sands, marls, and clays.

"The natural supplies of fresh water for these open wastes are derived from uncertain accumulations of rain products in small reservoirs, or occasional permanent springs, the latter generally occupying situations in close proximity to mountain ranges.

"All these basins not directly connected with the Rio Grande valley receive and absorb the drainage of their respective mountain boundaries, except in the higher elevations, rarely showing running water, unless as the temporary result of local rains.

"The above indications are favorable to the formation of aqueous substrata, which may be reached by sufficiently deep boring, and when located at the lower depressions of these basin areas, the water would necessarily be brought to the surface."

Nearly all the rain that falls upon the scattered mountains probably passes underneath the surface before reaching the foot-slopes, since the coarse angular debris of the mountains extend high up their sides, permitting the water to percolate through and descend into the permeable strata.

It will be noticed that nearly all the mountain streams and drains sink before reaching the plains, and others sink on the plains when they reach a porous soil. Where a deep vertical cut has been made in the strata, as, for instance, in the valleys of large rivers, they reappear, running under the permeable and above the impermeable strata. From these facts and considerations it appears that this country, at times almost destitute of water on its surface, has subterranean ponds, and streams, at no great depth below, which can be made to furnish water at the surface, in some instances by artesian wells, and in others by ordinary wells.

This opinion is confirmed by that of Mr. Blake, geologist of the party commanded by Lieutenant Williamson, whose description of the series of small basins lying in the Great Basin applies strictly to those under consideration. The formations are identical. Mr. Blake has detected the existence of regularly stratified tertiary formations in these basins, in which the success of artesian wells is certain. This question will, however, be satisfactorily solved by boring, as the economy of construction is involved to some degree by the facilities of finding water sufficient for working parties during the construction of the road.

The most unfavorable condition, towards the termination of the dry season, has been presented above. At other seasons lakes and springs will furnish water at much shorter intervals; but the first step in the construction of the road will be building wells between the points of abundant supply. It is supposed that the two ends of the road from the Mississippi and Pacific will reach the Rio Grande and the point of departure from the Gila at the same time, and that the road across the intervening space will be commenced at the two ends.

FUEL.

The report of Lieutenant Parke is not very positive upon the subject of fuel; but it is probable that a very scanty supply for the working parties will be found between the Rio Grande and Tuczon. Should the dwarf mezquite be found in the usual quantity, with grama grass, west of the Rio Grande as east of it, fuel for the working parties will be had along the route without great expense; should it not be, however, the supply will be very scanty. From Tuczon to the Gila there is no fuel whatever, but little or no grass, and at certain portions of the year no water. The deficiency must be supplied from the Rio Grande and the Gila, and, if necessary, by the portions of the road already built, from the Guadalupe mountains, and from the forests on the mountains at the sources of the Rio Mimbres, some 30 miles distant from the route near Cook's spring, and from the Mogoyon and other mountains at the sources of the Gila, San Francisco and Salinas rivers.

The climate is so mild as to require but little more fuel than is necessary for culinary purposes, and the trace so favorable as to require but small working parties. Should the line along the San Pedro be found practicable, the desert between Tuczon and the Gila will be avoided, and the expense of supplying fuel to working parties from the Gila to the point of leaving the San Pedro be saved.

TIES—LUMBER.

For ties, the lumber of the Sacramento and Guadalupe mountains, and, if necessary, from the eastern portion of the route, must first supply them; then the mountains at the sources of the Rio Mimbres, should it be found economical to resort to them, and the source of supply for the road along the Gila, which will be pointed out presently. Lumber will come from the same points.

GENERAL REMARKS.

A party under Lieut. Parke has been directed to make further examinations and surveys in this region, and to give especial attention to the geological structure, with a view to the location and construction of artesian wells.

If the cost per mile of making wells and supplying fuel for culinary purposes from distances unusually great on railroad routes, will add to the usual expense of construction, the regularity, smoothness, and hardness of surface, mildness of climate, and absence of heavy rains, which will dispense with the usual precautions taken against frost, will so far obviate the necessity of the most costly item of construction of a railroad, as to make the construction over this and similar regions of country a positively economical one. The road must be made, as far as practicable, and, as before remarked, as far as consistent with a good adjustment of economy of time with economy of means, to transport its own material. Short sections should be built at a time, so as to have railroad transportation near the working parties. Building-stone, lime, sand, &c., are found at various convenient points along the route.

The further examination of this region, to be made by Lieut. Parke, will no doubt develop more favorable lines even than that gone over. The labors of the Mexican boundary survey, now in progress, will also furnish further information respecting this country.

To resume the route: We have now reached the Gila, seven miles above the Pimas villages, the elevation above the sea being 1,365 feet. From this point to its junction with the Colorado, the valley of the river is highly favorable to the construction of a railroad. There will be no necessity for embankments against freshets, but trifling occasional cutting and filling; and in those instances where the hills close in upon the river, there is ample space for the road without heavy cutting. The elevation at the mouth of the river being 108 feet, and the distance between the two points 223 miles, we have a general slope of 5.6 feet per mile, which, from the favorable character of the ground, may be assumed as the grade of the road.

Water and fuel for working parties are sufficient, though no grass. Logs may be driven down the Gila from the Mogoyon mountains at its source, from the Pinal Lleno, and down the San Francisco and Salinas rivers, from the pine forests on the former, and the mountains at the sources of the latter. But it may be found more economical to receive all the supplies of lumber needed from the western portion of the road, either from the San Bernardino mountains and pass, or from the harbors of San Pedro or Diego, or, should it be found desirable to establish one, from the depot near the mouth of the Gila.

3. FROM THE MOUTH OF THE GILA TO SAN FRANCISCO.

The most favorable point for crossing the Colorado is at the junction of the Gila where the river is narrowest, 650 feet wide, and has bluffs on both banks.

The direction that the road should take across the desert intervening between it and the foot of the Coast range, depends in part upon the position of the pass by which it crosses this mountain chain. There are two passes known and explored. Warner's, the more southerly of the two, will require five miles of excavation in granite and mica-slate for the full width of the road, the grades varying from 130 to 190 feet per mile. Thence to San Diego by the San Luis river there is a practicable route, but at great cost of cutting on the river to San Luis Rey; thence along the seacoast numerous gullies will require bridging. The distance from the mouth of the Gila, over the desert, to the entrance of this pass, is 80 miles; thence to San Diego is 150 miles. The San Gorgonio or San Bernardino Pass, on the contrary, is remarkably favorable. It is an open valley, from two to five miles wide, the surface, smooth and unbroken, affording in its form and inclination every facility and no obstruction to the building of a railroad. Leaving the Colorado, it would be better to keep upon the alluvial soil, passing to the south of the sand-hills, and thus avoid the hard gravelly plain, where it would be necessary to bore considerable depths for water, and where the success of artesian wells is not certain; and it is also desirable to avoid the drifting sand of the gravel plain. But this obliges the road to pass over Mexican territory. The entrance of the San Gorgonio Pass is 133 miles from the mouth of the Gila in a straight line, over a smooth and nearly horizontal plain, which requires scarcely any preparation for the superstructure of a railroad. Thirty or thirty-five miles of this lies upon the gravel plain; the remainder passes over alluvial soil, which only needs irrigation to be fruitful. The first work is to construct wells at every few miles for the use of the working parties. On the alluvial soil, water will, no doubt, be found at a depth of 30 feet; and should deep or artesian wells fail to give a supply on the gravel plain, the expense of hauling it to the working parties for that distance will not be serious. Sufficient fuel for culinary purposes will, perhaps, be found on the alluvial plain—none on the gravel plain; but it can be supplied from the mountains at about double the cost in the eastern States.

The elevation of the mouth of the Gila is 108 feet, and the grade across the plain nearly horizontal. Approaching the pass, we have for 10½ miles an ascending slope of 40 feet per mile; then for 6 miles, one of 89 feet per mile. We are now at the point 133 miles from the mouth of the Gila. The natural slopes along the line of survey are—

13	miles, at	60	feet per mile,
2	"	132	"
7	"	75	"

to the summit, 2,808 feet above the sea. Descending to the town of San Bernardino, we have—

8⅓	miles, at	72	feet per mile.
2.7	"	79	"
2	"	77	"
1.3	"	127	"
4	"	75	"
6¼	"	41	"

near the town of San Bernardino, at an elevation of 1,120 feet above the sea.

The above enumeration is made to show that practicable grades can be had by following the natural slopes of the ground without cutting and filling, or side location, and therefore without great expense. The greatest grade is 132 feet per mile, for a distance of 3¼ miles. They can be modified, however, and reduced, without rock-cutting, so as not to exceed, perhaps, 80 feet per mile. Abundance of water can be got by digging wells, either on the pass or on the Pacific slopes. The San Bernardino and San Gorgonio mountains, north and south of the pass, 9,000 and 6,000 feet high, afford pine and fir timber at about one quarter the distance up their slopes. On these two mountains the growth of timber is thick, consisting mostly of pine and fir.

Should it be considered necessary to connect the harbor of San Diego (distant about 120 miles) with this pass, the general features of the country between it and San Luis Rey (about 75 miles) are favorable to the construction of a railroad. It may be described as a great plain, with numerous hills from 500 to 1,000 feet in height, irregularly distributed on its surface, sometimes assuming the form of a range several miles in extent, between and around which a road may be carried with favorable grades without expensive cutting and filling. It is plentifully supplied with water and fuel and good building-stone. From San Luis Rey to San Diego (about 40 or 45 miles) the unfavorable topographical feature along the coast is the numerous, intricate, deep gullies cut into the plain by its drainage, and which it would be necessary to bridge—the average width to be bridged being between 100 feet and 200 feet; the bridging might amount to one-fifth or one-tenth of the whole distance.

We have now reached the Pacific slopes and harbors which will at least afford great facilities in the construction of the road eastward, and which should be connected with it. The harbor of San Diego is excellent, but not capacious. The harbor of San Pedro is entirely open to the south and southeast, the quarter from which the sudden storms and dangerous winds of the winter come. Should it be selected as the depot from which the materials and supplies for the construction of the road eastward to the Rio Grande are to be drawn, the question of constructing a breakwater for protection against the winter southeast storms should be considered. It would be in a depth of 30 feet.

But the great object of the Pacific railroad will not be accomplished unless a connected line can be had to the best harbor on its coast, that of San Francisco.

If a practicable pass exists leading from the plains of Los Angeles to the valley of the Salinas river, it will give the most direct route, and that which will probably require the least ascent. A party is now making the explorations and surveys to solve this question. With the present information, San Francisco must be reached by crossing the Coast range to the Great Basin, passing over its southwestern extremity, (a nearly horizontal plain,) then crossing the Sierra Nevada and descending into the Tulares valley. From the western extremity of the San Gorgonio Pass two routes present themselves by which we may cross the Coast range and reach the Great Basin. The nearest is the Cajon Pass, which, beginning at the Pacific side, has, over the distance of 11½ miles, natural slopes varying from 90 to 100, 117, 142, 159, 171 feet per mile; then a tunnel is requisite, 3 or 4 miles long, ascending constantly 100 feet per mile, the ground at the highest point being 1,600 feet above the tunnel. Lieut. Williamson is of opinion that these high grades cannot be much reduced by location on the side-hills. Lieut. Whipple thinks that they can.

The "New Pass," made known by Lieutenant Williamson's explorations, is more favorable than the Cajon. It is along the headwaters of the Santa Clara river, to reach which it is necessary to cross the divide between one of its tributaries and one of the Los Angeles river, through the San Fernando Pass, near the mission of San Fernando. From San Bernardino to the mission of San Fernando, 78 miles, the road may pass over a country requiring gently undulating grades, and in other respects presenting features highly favorable to its construction. There is good building-stone and plenty of water and fuel. Ties and lumber can be brought from the mountains. The soil is fertile and well watered, excepting on the divides and in some elevated places where irrigation must be resorted to. This promises to be a highly cultivated, populous, and rich region of country. A branch road about 25 miles long to San Pedro from near Los Angeles, over ground favorable to cheap construction, will enable that port to be used for lumber, iron, coal, and all the materials and supplies for the construction of the road eastwardly.

In the San Fernando Pass the natural slopes on the south side must probably be followed, as deep ravines cut up the hills on either side. Rising from the mission of San Fernando 600 feet in 4.4 miles, at the rate of about 155 feet per mile, we reach a point where a tunnel must be cut through soft sandstone, one-third of a mile long, at an elevation of 1,746 feet. We then have a descending grade for 4 miles of 115 feet per mile. This part of the pass is narrow, and will require side and other heavy cutting in earth. Hence to the point where the grades of the New Pass are given on the profile of Lieutenant Williamson is 7 miles, with an ascending grade of 55 feet per mile.

In the new pass an excavation in drift, (clay, gravel, &c.,) 40 or 50 feet in depth, for a short distance at the summit, and a side location which will not require much cutting, will give an average grade of 67 feet per mile; the natural grades without side location are 55, 37, 58, 73, 62, 70, 105, and 77 feet per mile for 22 miles to the summit. In a portion of the approach, about one mile in length. where the mountains close in precipitously and the stream winds abruptly, it may be necessary to cut two or three short tunnels 100 or 300 feet long through slaty granite. The summit of the pass is 3,164 feet above the sea. East of it for a distance of 1.35 mile the direct natural slope is steep, 240 and 218 feet per mile, and the ground will require cutting and filling to adjust the grade for a distance of at least three miles to that west of the summit. It must probably be 100 feet per mile. From this point to the elevation which will probably be maintained in the Great Basin, about 2,900 feet, the grade may be any that is desirable, and the ground will require little or no preparation for the superstructure.

The San Francisquito Pass (on one of the main tributaries of the Santa Clara river) is more direct than the New Pass, but, if not positively impracticable, is at least difficult, and the grades are excessive.

Having now reached the Great Basin, we have several passes by which to enter the Tulares valley.

In the *Cañada de las Uvas* Pass, elevation of summit 4,256 feet, the average slope for 5½ miles from the summit to the Tulares valley is 302 feet per mile, the maximum being 345 feet per mile, and the minimum 229 feet per mile. But the bounding hills are so cut up with deep ravines, that the average grade cannot be had, and the natural slope must be used.

In the *Tejon* Pass, elevation of summit 5,285 feet, beginning at the western entrance, for 2.83 miles the slope is 173 feet per mile; for 11.4 miles the average slope is 234 feet per mile, supposing a side location; then a tunnel 1.15 mile long; then a descending slope towards the Great Basin of 205 feet per mile for 6.4 miles, supposing a side location.

The next the Tah-ee-chay-pah Pass, elevation of summit 4,020 feet; ascending to it from the Tulares valley in 15½ miles with natural slopes, varying through 153, 176, 192, (for 1½ mile,) 119, and 157 feet, and eight feet per mile, and descending towards the Great Basin nine miles, at 80 feet per mile, the remaining distance being with gentle grades.

Walker's Pass, elevation of summit 5,302 feet, requires a tunnel of four miles, has a slope in ascending to the summit from the Great Basin of 265 feet per mile for six miles, of 272 feet per mile descending for 6½ miles; and just before the Kern river debouches into the Tulares valley, there is an impracticable cañon of five miles.

It is very evident that the most favorable of these passes is the Tah-ee-chay-pah. From the summit to the Tulares valley a side location in earth-cutting can be made, giving an average grade of 144 feet per mile for 17 miles. The steep grade can be extended four miles further, entering the Tulares valley at a lower elevation than that of 1,489 feet. The New Pass and Tah-ee-chay-pah Pass may be connected by an almost horizontal grade around the border of the Great Basin, keeping along the foot of the eastern slopes for about 25 miles, where supplies of water can be had either from springs, small streams, or common wells or artesian wells; then crossing in a nearly straight line to the entrance of the Tah-ee-chay-pah Pass, descending to a fine spring of water, elevation 2,668 feet, and ascending to the entrance, elevation 3,300 feet, and at a distance from New Pass of about 60 miles. The whole of this surface is prepared by nature to receive the superstructure of a railroad. It has two intervals of 13 and 17 miles where there is no water; but it can be supplied either by hauling or by digging or boring wells. Fuel, ties, lumber, stone, &c., over this distance of 60 miles, as well as for an additional distance at both ends, must come from the adjoining mountains, where it is abundant. The working parties over this part will be small.

Having entered the pass at an elevation of 3,300 feet, there will be 12 miles of grade at the rate of 22 feet per mile; then, as before stated, nine miles at 80 feet per mile. The ground admits of these grades being arranged to suit those descending to the Tulares valley, which commence after a nearly horizontal grade at the summit for 7½ miles. From the manner in which these two passes are connected by an almost horizontal line after descending about 500 feet from the summit of New Pass, they have, combined, the disadvantages attending only one pass, with a summit elevation of 4,300 feet; and after descending the Pacific slopes through the San Gorgonio Pass to an elevation of 1,118 feet, we have reached the Tulares valley by ascending 3,900 feet; and descending again to an elevation of about 1,500 feet above the mean level of the ocean. From the head of the Tulares valley, the waters of the Bay of San Francisco, navigable for sea-going vessels of large draught, may be attained in several ways.

The eastern side of the Tulares and San Joaquin valleys is intersected by numerous streams from the Sierra Nevada. The western is bounded by the coast chain, and has few streams. That part of the Tulares valley between Kern and San Joaquin rivers, a space of 160 miles having a soft alluvial soil, is at certain seasons miry. A road, therefore, extending though it, should keep near the foot-slopes of the mountains. From the Tah-ee-chay-pah Pass to the best point of crossing Kern river, 21½ miles, the route passes over a dry dusty plain, destitute of water and fuel, the soil of which is not well constituted for fertility. The elevation at the crossing being about 500 feet, the general grade will be, for the first ten miles, 78 feet per mile, and for the remaining eleven and a half miles, 18 feet per mile.

From the crossing of Kern river to the second crossing of the San Joaquin, at or near Grayson's, the distance is (the route keeping near the foot of the mountains) 253 or 260 miles—the general descending grade two and a third feet per mile. The numerous river-beds or bottoms should be crossed on piles, the spaces varying from 50 to 300 feet, the greatest width of the portions to be spanned not exceeding 100 feet. This is not proposed as the route for a railroad, but merely to give a general idea of the distance and character of country which separates the head of the Tulares valley from the navigable waters of the Bay of San Francisco. The total distance from the Tah-ee-chay-pah Pass to the Straits of Martinez is 354 miles, following the route travelled by Lieutenant Williamson; but the location distance of a railroad would be 288 miles.

The most direct route to San Francisco from the Tah-ee-chay-pah Pass, will be found through one of the passes known to exist in the mountain range separating the San Joaquin valley from those of the Salinas river and San José river. The distance through them is about ten miles; the elevation of their summits about 600 feet. They may be reached from the Tah-ee-chay-pah Pass by passing around the head of the Tulares valley to its western side, or by keeping on the eastern side of the Tulares valley fifteen or twenty miles after crossing Kern river; then crossing the valley, in doing which it will be necessary to use piling for the distance of ten miles, to make a sufficiently firm road-bed over the soft, miry, alluvial soil. The distance to the port of San Francisco, by this route, from the Tah-ee-chay-pah Pass, is about 288 miles. The average grades, except through the short pass, will be two or three feet per mile.

The soil of the Tulares and San Joaquin valleys is well constituted for fertility, and needs merely the proper amount of water to be highly productive. There are settlements along the eastern side of these valleys under the mountains. The San José valley is one of the best cultivated and most populous districts of California.

Sufficient water and fuel for working parties can be found at convenient distances on this section, and lumber and good building-stone at various points along the line in the mountains, fifteen or twenty miles from the foot of their western slopes.

The sum of ascents, therefore, between the summit of the San Bernardino Pass and the port of San Francisco is 4,516 feet, (supposing the height of the pass through the coast mountains 600 feet,) the distance 521 miles.

This portion of the route is generally of a different character from that east of the Sierra Nevada and Coast ranges. Its topographical features, except the mountain passes, are favorable to the cheap construction of a railroad. The comparative proximity throughout the line of forests of pine and other trees, of good building-stone, and other materials for construction; of supplies of water and fuel for the working parties; the fertility of the soil along large portions of the route, which by irrigation from unemployed mountain streams may be made productive,—these circumstances, together with the population already occupying certain portions of the route, afford the means of estimating how far the cost of the construction, and working of the road, will exceed that under nearly similar topographical circumstances in the eastern States, so far as similarity of topographical features can exist between countries of such different formations.

The mountain passes are of a favorable character, their only objectionable feature being their high grades. Excepting at a few points, and for short distances not exceeding a mile or two at a time, they do not require heavy embankments, or difficult bridging, or heavy side-cutting in rock or even in earth. The only rock-cutting needed is that at the summit of the San Fernando Pass, through soft sandstone one-third of a mile, and in the New Pass, where, for the space of a mile, two or three tunnels, 100 and 300 feet in length, through slaty granite, will probably be required, with a cutting of 43 feet in clay, granite, &c., at the summit, for no great distance.

The construction, however, will cost more per mile in this distance of 521 miles, than between the Sierra Nevada and the Rio Grande. In regard to the grades, there is on the Baltimore and Ohio railroad a grade of 117 feet per mile for a length of 17 miles. A 24-ton engine, on six drivers, can draw a train containing two hundred passengers, with 100 pounds of baggage each, in the worst condition of the rail, up a grade of 221 feet per mile, and a train of three hundred passengers and baggage up a grade of 150 feet per mile.

The maximum loads are rarely carried over long roads. Even supposing twenty-ton engines used, with maximum loads for the grades over other portions of the road, it would merely be necessary to divide the load into three parts to pass a grade of 150 feet to the mile, over the distances through which they extend, supposing the load previously adjusted to a grade of 40 feet per mile: in other words, to reduce a grading of 150 feet to the mile, to one of 40 feet to the mile, the expense of two additional engines, and the cost of working them through the pass, must be added.

For more detailed information in regard to this, I refer to the memoranda and tables prepared by Capt. McClellan, Corps of Engineers, and the following extract from the report of Allan Campbell, Esq., an able American engineer, upon the railroad from Valparaiso to Santiago.

EXTRACT FROM THE REPORT OF ALLAN CAMPBELL, ESQ., CHIEF ENGINEER OF THE VALPARAISO AND SANTIAGO RAILROAD.

"From the known topography of Chili, and particularly from the facts stated in the preceding pages, it will naturally be inferred that a railroad route from Valparaiso to Santiago is only to be obtained by resorting to gradients of extreme acclivity.

In no country where railroads have yet been constructed are more gigantic physical obstacles encountered. I refer particularly to the elevations to be overcome, and not to the labor or cost of constructing the road, because in this respect it presents a very favorable aspect. The only alpine region where this species of improvement has yet been extensively introduced, is that of the eastern part of North America. There the Allegheny mountains, stretching along the Atlantic coast from two to three hundred miles inland, separate that ocean from the rich and extensive valley of the Mississippi.

The trade and commerce of this vast western region has long been the aim of the principal cities situated on the Atlantic. In the various works of canals and railroads constructed for the purpose, nearly two hundred millions of dollars have been expended. Stimulated by the great prize held out, the resources of States and cities have been bountifully applied; private capital has been unsparingly devoted, while the genius and skill of engineers have been developed in the noble rivalry.

Boston, New York, Philadelphia, Baltimore, Charleston, and Savannah, have all engaged in the construction of railroads leading westward. Some of these lines are now completed, and others are approaching their termination. As these works pass over a country bearing a strong resemblance in its topography to that part of Chili now under consideration, some notice of their principal features will not be uninteresting.

Without entering into minutiæ, it may be stated, that the several routes are from three hundred to five hundred miles in length, amounting in the aggregate to about twenty-five hundred miles; and, wonderful to relate, this vast extent of road is carried over such an elevated region without a single inclined plane, worked by stationary power. Some of the lines were originally operated in this manner, but they have been made to give place to gradients suited to the locomotive engine. This fact will show the great importance attached to this consideration in a country where routes affording the cheapest and most rapid method of transport are aimed at.

The route from Boston passes over a summit 1,500 feet above the ocean, with a maximum gradient of 83 feet per mile. Two roads lead from the city of New York to the western waters; one through the valley of the Hudson river, with a summit of only 650 feet above tide, and a maximum grade of 30 feet per mile; and another, (the Erie railroad) whose highest point is 1,700 feet above the Atlantic, on which grades of 70 feet per mile are adopted.

Proceeding southerly, the mountains attain a higher elevation, and the routes from Philadelphia and Baltimore are carried over very elevated summits; that of the former being 2,400 feet, with gradients of 95 feet per mile, and the latter about 2,600 or 2,700 feet, with a maximum gradient of 116 feet. As this latter work so closely resembles the Santiago road, I shall have occasion, presently, more particularly to speak of it.

Proceeding still farther south, the mountains again decline, and the Charleston and Savannah routes cross them at an elevation of 1,500 feet with very moderate grades, not exceeding 40 feet per mile.

Except the Baltimore and Ohio railroad, (one of the lines above mentioned) the exact height of whose summit I cannot state, none of these great thoroughfares pass over ground so much elevated above the sea as the Santiago route; and as all, in this respect, far exceed the works of other countries, it may safely be said that the route described in these pages overcomes a greater elevation than has yet been surmounted by railroad, (except perhaps in one instance,) throughout the world. But the Santiago route is superior to most of the American roads above enumerated in one respect. In approaching to, and departing from their main summits, those roads cross over numerous secondary ranges and deep intervening valleys, which makes the aggregate rise and fall much greater than the Santiago road, as will be seen by the following table:

Road.	Length in miles.	Elevation of summit above the sea.	Total rise and fall.	Maximum grade per mile.	Remarks.
Boston route	500	1,440	4,700	83	
New York route, (Central)	440	650	2,100	30	
New York route, (Erie)	460	1,720	6,500	70	
Philadelphia route	340	2,400	5,600	95	
Baltimore route	390	2,600 or 2,700	7,000	116	Rise and fall, and summit, supposed.
Charleston route	490	1,400	5,000	40	Rise and fall, supposed.
Savannah route	440	1,400	5,000	40	Do. do.
Santiago railroad	110	2,640	4,340	119	

Although the total elevation surmounted by European railroads is much less than in the cases above cited, yet even there, in some instances, inclinations equal to the maximum gradient of the Santiago road are now introduced, and overcome by locomotive power. Two or three instances may be mentioned.

In a work entitled "The Practical Railway Engineer," published at London, in the year 1847, is the following description of the Edinburgh and Glasgow railroad:

"The gradients vary from one in 880 (six feet per mile,) to one in 5,456 (about one foot per mile,) except one incline of one mile, fourteen chains in length, which descends from the Cowlairs towards the Glasgow station, at the rate of one in forty-three (123 feet per mile,) and has hitherto been worked by stationary steam-engines, which are now, or are about to be, replaced by American locomotive engines."

Dr. Lardner, a distinguished writer on various scientific and practical subjects, in a late work entitled "Railway Economy in Europe and America," after giving a table of the German railways, says: "In the first and third columns of this table are given the characteristic or prevailing gradients and radii; and in the second and fourth columns are given those which occur only exceptionally, when the character of the ground rendered them inevitable. In some cases—as, for example, in the section of the railway constructed from Brunswick to Harburgh, on the left bank of the Elbe, facing Hamburgh—the prevailing gradient is 1 in 166 (32 feet per mile;) but in one section of this line, extending over a distance of about five miles, being the section between Hamburgh and the station of Weinenburgh, there is a series of gradients which vary from 1 in 100 (53 feet per mile,) to 1 in 50 (106 feet per mile.) No practical difficulty, however, is encountered in the regular working of this part of the line by locomotives without assistant engines. Trains of an average gross weight of sixty or seventy tons are drawn over this section by locomotives whose weight does not exceed eighteen tons, having six coupled wheels of four feet nine inches in diameter."

In the table mentioned, the maximum gradient of the Brunswick and Harburgh railway is stated at 1 in 43 (123 feet per mile,) and those of Wurtemburgh at 1 in 45 (117 feet per mile.)

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The grades of the Santiago railroad, though heavy, are, in comparison with others which have been cited, not unfavorable; and we find on analyzing the expense of operating a railroad, that the cost of motive power is only a fractional part of the whole. It is sufficient for our present purpose to know that important railroads in other countries, with gradients equal to those of the Santiago route, have been, and now are, successfully and profitably conducted. One important fact in this connexion is, that the line now under consideration will be free from the evils resulting from snow and ice, which diminish the adhesion of the engine to the rails, and reduce its effective power. Snow rarely lies even at the highest level over which this route is conducted.

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It will naturally occur to many that the descent of trains on gradients of such great declivity, with perfect security to the lives and limbs of passengers, is quite as important a consideration as their ascent with profitable loads. The accounts which follow, founded on fact and official information, afford the most satisfactory evidence on this point.

A branch of the Baltimore and Ohio railroad, in the United States, has gradients of 135 feet per mile, which are worked entirely by locomotive engines. The descent is made with heavy loads in perfect safety, and a single engine takes up regularly a gross load of 66 tons, exclusive of the engine and tender. On one road in the State of New York a short gradient of 175 feet per mile is descended daily with passenger trains.

The superintendent of the Baltimore and Susquehanna railroad, an important line both for freight and passengers, writes as follows: "We have one grade of eighty-four feet per mile, three miles in length. Over this grade a locomotive weighing 26 tons hauls, at the rate of twelve miles an hour, forty (four-wheel) cars, each containing three tons of produce—the cars themselves weighing 114 tons—making a gross load of 234 tons."

The most interesting and analogous case, however, to which I can refer, is that of the Baltimore and Ohio railroad, one of the great lines of the United States alluded to in a previous part of this article, as connecting the sea-board with the valley of the Mississippi across the Alleghany mountains.

In the year 1850, 477,000 tons of merchandise and 180,000 passengers were transported on this road, the receipts amounting to $1,343,000, the road being only about half completed. When finished to the Ohio river, its receipts are expected to amount to $3,000,000. On this road are heavy gradients, with several curves of six hundred feet radius, and some of four hundred feet. It is to the mountain district of the road just opened that I wish particularly to invite attention; and for this purpose an extract is made from the official report of the chief engineer, Mr. Latrobe, one of the most distinguished engineers of North America, in which he describes the route and grades over the Alleghany mountains:

"At about a mile below this last point, the high grade of 116 feet per mile begins and continues about 11½ miles, crossing the Potomac from Virginia into Maryland near the beginning of the grade, and thence ascending the steep side-slopes of Savage river and Crab Tree creek to the summit at the head of the latter, a total distance of about fifteen miles, upon the last three and a half of which the grade is reduced to about 100 feet per mile. From the summit the line passes for about nineteen miles through the level and beautiful tract of country so well known as the Glades, and near their western border the route crosses the Maryland boundary at a point about sixty miles from Cumberland, and passes into the State of Virginia, in whose territory it continues thence to the terminus on the Ohio. From the Glades the line descends by a grade of 116 feet per mile for eight and a half miles, and over very rugged ground, and thence three miles further to Cheat river, which it crosses at the mouth of Salt Lick creek. The route, immediately after crossing this river, ascends along the broken slopes of the Laurel Hill by a grade of 105 feet per mile for five miles, to the next summit, passing the dividing ridge by a tunnel of 4,100 feet in length, and whence, after three miles of light grade, a descent by the grade of 105 feet per mile for five miles is made to the valley of Racoon creek, by which, and the valley of the Three Forks creek, the Tygart's Valley river is reached in fourteen miles more, at the Turnpike bridge above described, and 103½ miles from Cumberland."

The foregoing extract exhibits in a few words the physical obstacles to be overcome. It will be seen that a gradient of 116 feet per mile, both ascending and descending, is required—in the aggregate amounting to twenty miles—and that in both directions there are also thirteen miles more with gradients exceeding 100 feet per mile."

Two important remarks upon the characteristics of the railroad from Valparaiso to Santiago, which will be found in the preceding extract from the report of Allan Campbell, Esq., are equally applicable to the route of the 32d parallel. The first is the favorable character of the approaches to the mountains, by which no numerous secondary ranges and deep intervening valleys are to be crossed, as in the railroads crossing the Alleghany mountains; and the second is, that the line will be free from the evils resulting from snow and ice, which diminish the adhesion of the engine to the rails, and reduce its effective power. Not only are these two remarks fully applicable to the route of the 32d parallel, but the features of the mountain passes are even more favorable than those of the route discussed by Mr. Campbell.

There will be more snow and ice in the Tah-ee-chay-pah Pass than in any other on the route of the 32d parallel; but there is no probability of their being found in sufficient quantity to obstruct in the least the working of the road. In the absence of positive information upon this point, the examination which follows may give some general indication of the climate there.

The absence of snow and ice in these passes is especially important with the high grades proposed to be used. These can in every instance, except one, (the San Fernando Pass, over four and perhaps eight miles,) be reduced by side location to grades in use on several principal railroads. But cars are carried safely over grades nearly double the greatest here proposed for temporary use, and the increased cost of employing additional engines over these portions of the road is not in the least serious, compared with the additional expense and loss of time required to secure easier gradients.

The winter temperature of San Francisco is 50° Fahrenheit. The Tah-ee-chay-pah Pass is about 3° south of San Francisco, and at the same level would have a winter temperature of 53°. The elevation being 4,000 feet, would give, by the usual rule, a temperature from 13° to 15° lower, or a mean winter temperature of 40° or 38°. It is probable, however, that it is somewhat lower than this, which is about the mean winter temperature of Fort Monroe, Old Point Comfort, Chesapeake bay. The mean winter temperature of Charleston is 50°, and that of the summit elevation of the railroad route westward to the Mississippi, 1,400 feet above the sea, is about 45°.

The mean winter temperature of Fort McHenry, Baltimore harbor, is 32°.7; that of the summit elevation of the Baltimore and Ohio railroad, 2,600 feet above the sea, should be about 24°, which is 14° or 16° lower than that obtained for the Tah-ee-chay-pah Pass.

There is deep snow in the Tejon Pass, but from the open character of the Tah-ee-chay-pah Pass, and its greater distance from the junction of the two chains of mountains, the snow and ice found there will not probably be seriously disadvantageous.

GENERAL REVIEW.

Among the general considerations which determine the position of the route near the 32d parallel, the most prominent are the low elevation of the mountain passes, and their favorable topographical features, as well as those of the table-lands, embracing over 1,000 miles of the route; the favorable character of the surface generally, by which the most costly item of construction in railroads, the formation of the road-bed, is in a great measure avoided; the shortness of the line, 1,600 miles, from the navigable waters of the Mississippi to the Pacific, and the temperate climate on the elevated portions in this southern latitude.

The principal characteristic of this route is the great extent of high, arid, smooth, and nearly horizontal table-lands which it traverses, reaching an elevation of 4,000 feet upon the dividing ridge between the Brazos and Colorado rivers of Texas, near which elevation it continues until it descends from the pass of the Sierra de Santa Catarina to the Gila river, a space of nearly 600 miles.

The elevation at the summit of the Llano Estacado is 4,700 feet, and in the passes of the Guadalupe and Hueco mountains, east of the Rio Grande, 5,700 and 4,800 feet respectively. Between the Rio Grande and the Gila, the greatest elevation, which is twice attained, is 5,200 feet; the mean elevation before the descent to the Gila is commenced being 4,100 feet.

From the eastern edge of the Llano Estacado to the pass of San Gorgonio, 1,052 miles, the route crosses three rivers—the Pecos, the Rio Grande, and the Great Colorado of the West.

The peculiar features of the arid region over which the route lies, from the eastern edge of the Llano Estacado to the summit of the San Gorgonio Pass, have been sufficiently explained in the detailed topographical review already given of each portion of this route. Those very characteristics which were thought to offer the greatest obstacles to the construction of a railroad, prove, when closely examined, the most favorable, since they have obviated the necessity of much of that most costly item in railroad construction, the preparation of the road-bed for the superstructure. Throughout the distance of 1,052 miles, with few and limited exceptions, this preparation is already made by nature, and quite as perfectly as, if not better than, it could be done by the hand of man. This item alone usually amounts to from one-half to two-thirds and sometimes three-fourths of the whole cost of a railroad.

The mode and probable cost of obtaining supplies of water over these dry regions have been pointed out and will be subjected to practical tests. Even if these should fail (of which there is no probability) in bringing the required supplies to the surface, the permanent streams and large springs already existing are at distances sufficiently near for the purposes of a railroad, special arrangements having been made to meet the difficulty.

For a 20-ton engine, on four drivers, wood and water, if carried with the train for 25 miles, weigh about $\frac{1}{84}$th of the maximum load on a level, and for 100 miles $\frac{1}{22}$d part; with coal and water the proportions are, for 25 and 100 miles $\frac{1}{115}$th and $\frac{1}{28}$th; but as the load usually carried on freight and passenger trains is much below the maximum, we may safely assume that the trains (freight and passenger) can carry fuel and water sufficient for 100 miles over grades not exceeding 30 or 40 feet without additional cost, the maximum load of this engine on grades of 40 feet, in the best condition of rail, being 252 tons, and in the worst condition 180 tons.

That required for the use of the working parties can be hauled without seriously enhancing the cost of the road, for it must be remembered that the working parties will be small over those portions of the route where the road-bed has been already prepared by nature. We have seen, too, that fuel for culinary purposes for the working parties will probably be found over the greater part of these regions; and where it cannot be found conveniently, that it can be supplied from points so near to the work that its cost will not exceed double that of fuel for the same purposes in the eastern States.

From the eastern limit of the Llano Estacado to the Pacific, 1,200 miles, the plan of building the road has been indicated so as to secure the greatest economy of time and means. Three points remain to be considered: the mode and cost of supplying ties and lumber generally; the mode and cost of supplying fuel; and the manner in which the daily examination of the road can be made and the rails adjusted and protected.

TIES—LUMBER.

Let us assume the most unfavorable case for supplies of ties and lumber over that portion of the route between the eastern limit of the Llano Estacado and the summit of the San Gorgonio Pass, 1,052 miles—that is, that they must be brought from either end of the road, say 300 miles from the eastern limit of the Llano Estacado and from the port of San Pedro on the Pacific, 100 miles from the summit of the San Gorgonio Pass, making the points of supply 1,400 miles apart: the greatest distance to which they must be transported from each end is, therefore, 700 miles by the road, the point of junction of supplies from the east and west being about 110 miles west of the Rio Grande. Lumber can, undoubtedly, be procured in the Red River district for $30 per 1,000 feet. The additional cost for transportation to the Llano, 300 miles by the railroad, at three cents per ton per mile, (double the usual cost on eastern railroads) is $13½, and its cost there $43½ per 1,000 feet; the cost per 1,000 feet for 450 miles additional transportation is $20, and hence the cost per 1,000 feet at this extreme point will be $63½. The mean cost over these 400 or 450 miles from the eastern limit of the Llano Estacado will be $52½ per 1,000 feet. From Fulton to the Llano it is unnecessary to estimate its cost.

Lumber may be delivered at San Pedro or San Diego from Oregon for $30 per 1,000 feet. Abundance of it can be got out from the San Bernardino and other mountains near the line of the road at that cost, and it may be assumed, therefore, to be supplied at San Pedro or San Diego at that price, and at a mean cost over the road (the road supplying itself, as it must do, sections of 40 or 50 miles being built at a time) of $46 per 1,000 feet. The ties should be sawed to the smallest dimensions, if they must be transported to the distances stated. The dimensions may be six inches by eight inches, and their mean cost over these 1,200 miles will be about $34 per 1,000 feet, or the cost of ties per mile $1,760. It may be found desirable to return to the use of stone chairs, or to resort to cast-iron ties over this portion of the route. The latter would cost at eastern prices about $2 per tie.

The mean cost of rails, iron, &c., over this route will not exceed, if it equals, $30 per ton more than their usual cost in the eastern States. Haulage from temporary termini of railroad to unfinished line of road will be about double that in the eastern States; and, indeed, this appears to be about the mean proportion of increase on these great table-lands.

The worst case having been discussed, it remains to be said, that good ties and lumber can be obtained from the Guadalupe and Hueco mountains, from the headwaters of the Rio Mimbres, from the Pinal Lleno, Salinas river and headwaters of the San Francisco, and from the San Bernardino mountains of the Sierra Nevada or Coast range, which sources of supply may be found to materially obviate the necessity of transporting lumber from the two ends of the road.

FUEL.

Bituminous coal is abundant on the Brazos. The coal of Vancouver's island, and also of Puge sound, is excellent. Last summer a cargo was brought to San Francisco from Puget sound at a cost of $11 per ton; $4 per ton being for freight, and $7 per ton for mining and handling. It costs at present prices $5 per ton to mine it. This at no distant period will, doubtless, be reduced to $1 or $2 per ton, and it can be delivered at San Pedro or San Diego at $7 per ton. On the Brazos it can be mined and prepared for transportation at $1 per ton. From the Brazos to San Pedro is 1,400 miles. At three cents per ton per mile, (double the usual cost,) we have it at the foot of the Llano at $7 per ton, and the mean cost per ton over the 1,200 miles, $16.

In regard to transporting wood for fuel for locomotives, as 1,300 pounds of coal make as much steam as 4,500 pounds of pine wood, coal can be transported three and a half times as far as wood, other things being equal.

The cost of fuel on railroads is about one-fifth of the yearly expense of maintaining and working the road.

GENERAL REMARKS.

It may be found desirable to establish a depôt of supplies at the mouth of the Gila, 255 miles distant from San Pedro. The report of a reconnaissance near the mouth of the Colorado of the West, with a view to its navigation, by Lieutenant Derby, topographical engineers, shows that the navigation of this river to the head of tide-water, 40 miles from its mouth, is difficult and dangerous from the rapid rise of the tide called bore. Arnold's Point, 35 miles above the mouth of the river, by the windings of the stream, is the head of navigation in low water (January, February, and March) for vessels drawing nine feet. Above that point, to the mouth of the Gila, the least water is three feet, and the river may be navigated at any season by steamers drawing 2½ feet water. The channel is narrow, and the current, obstructed with small snags and sawyers, is always rapid. The distance from Arnold's Point to the mouth of the Gila is between 70 and 100 miles. The rise of the ordinary spring tides at the mouth of the Colorado is 12 feet. In freshets the river at Arnold's Point rises 15 feet above low water. The velocity of the current, independent of that caused by the tide, is ordinarily from one to three miles per hour, and in freshets nearly double that. Could the work of construction be commenced at the mouth of the Gila at the same time as at San Pedro and the other terminus, and extended east and west, it would hasten the completion of the work.

DAILY INSPECTION OF THE ROAD, &C.

Each portion of a railroad is thoroughly examined every day, and such adjustment and slight repair made as can be done by a single hand. One man attends to from two to three miles of road. From 1,000 to 1,300 miles of the country along this proposed route is uninhabited, except by Indians. Here it will probably be found necessary to establish stations at every 20 or 25 miles distance, capable of accommodating 40 men. As a party of seven or eight men on any portion of the route, with the facilities of a hand railroad car, may be considered perfectly secure against Indians, a party of three men with a guard of five will be able to inspect and adjust 10 miles of a single track; this would require a station for a guard of 25 or 30 men, and for eight or ten employés of the road, every 20 miles. Should the supplies of water be even 100 or 150 miles apart, sufficient could be carried to these parties without extra cost. This guard would not be required at every station; but supposing it necessary over the Indian country of 1,000 miles, it would amount to 1,500 men. As on many of the European railroads the average number of men employed solely for the purpose of preventing access to the railroad from the cross-roads of the country, and for attending to signals, &c., independent of those employed for switches, daily inspection and adjustment, and at the depots, is at least one per mile, their number would amount on a road of 2,000 miles in length, to 2,000 men; exceeding that required for *guarding* the road. Supposing this guard employed by the railroad authorities, it would not be in addition to the usual number of employés, but merely a change of their duties to suit new circumstances.

It is desirable to have stations with relays of engines, cars, &c., at every 100 miles; and favorable sites for those will be found on this route at about the required distance apart, with but two exceptions—one being the table lands west of the Rio Grande, and the other the Colorado desert—where the distances are about 150 miles.

But considerations of this kind, within certain limits, belong rather to questions of nice economy than to greater or less difficulty of working the road.

SOIL, &C.

The table-lands, extending from the cultivable soil of Texas westward, have generally a growth of grama grass. The principal exceptions are a large portion of the Llano Estacado, and for 70 miles of the descent to the Gila; nor is grass found in that portion of the valley of the Gila traversed by the route, although the soil is fertile; nor is it found on the Colorado desert, or on the crossing of the southwest corner of the Great Basin, &c.

The soil of the river valleys is fertile, but for cultivation needs irrigation. After leaving, for the first time, the body of the productive soil of Texas, we have the valleys of the Pecos, Rio Grande, Gila, and Colorado, portions of whose areas possess a fertile soil; the sum of these exceeds 2,300 square miles. That portion of California west and south of the coast range has a soil and climate which will admit of a dense population.

GENERAL ADVANTAGES OF THE ROUTE.

The mineral wealth of the countries near the 32d parallel has been indicated by others, and needs no other mention.

The proposed road passes near the northern borders of the Mexican States, or departments of Chihuahua and Sonora. They extend northward from latitude 27° or 28° to our boundary. The surface is generally table-lands, affording good grazing; the climate is agreeable. The soil of the river valleys is fertile, capable of producing, when irrigated, wheat, cotton, &c. Their wealth is principally in cattle farms and mines of gold and silver. The area is 280,000 square miles. The population exceeds 300,000.

Although this route passes near the frontier of Mexico, yet it is not liable to objection from this circumstance, since we control the frontier, and the construction of the road would probably break the power of the Indian tribes.

It passes through or near territories having already large populations; that of New Mexico, according to the report of Captain Pope, being 50,000; and that of Chihuahua and Sonora, as above stated, being more than 300,000.

The chief advantage of this route is, that for the space of 1,100 or 1,200 miles, the usual item of great expense in railroads is in a great measure avoided, there being no necessity to prepare an expensive road-bed except in a few instances in the passage of the mountain chains. Draining and ballasting are also dispensed with at the same time. Over the remaining portions of the route—418 miles if to San Pedro, and 839 miles if to San Francisco—the ground is generally favorable to the construction of the road-bed.

The mountain passes of the route are generally favorable; those west of the Rio Grande requiring no difficult engineering for location through them, and but little rock excavation or expensive embankment and side cutting. The Guadalupe and Hueco passes are more difficult. The short tunnel on the San Fernando Pass, and those that may be needed in the New Pass, will not be found difficult in their execution.

The climate throughout the route is salubrious, the heat due its southern latitude being moderated by the elevation of the table-lands. On the Colorado desert it is torrid, but not unhealthy, and west of the Sierra Nevada and coast range is celebrated for health and agreeableness.

From a consideration of these favorable circumstances, and after a close examination of all the sources of increased cost of construction, from the peculiarities of situation, climate, and geological and topographical formation, I am of opinion that the road may be built as a first class road, in regard to superstructure, rail, &c., and equipped sufficiently for the business that may be reasonably expected, for a sum that will not probably exceed $45,000 per mile.

The following estimate is submitted, including depots and equipment:

ESTIMATE.

From Fulton, on the Red river, to the Llano Estacado, 449 miles, at $35,000 per mile, 25 per cent. being added to the cost at eastern prices for one-half the distance; over the Llano Estacado, 125 miles, at $35,000 per mile, peculiarities of construction having been considered, and 50 per cent. at cost at eastern

prices having been added; the sum of the two distances being 624 miles, at $35,000 per mile		$21,840,000
From the Pecos to the Rio Grande, the cost being assimilated to that of the Baltimore and Ohio railroad for 80 miles, and 50 per cent. being added to the cost—80 miles, at $75,000 per mile	$6,000,000	
The remaining 83 miles, at $45,000 per mile	$3,735,000	
		$9,735,000
From the Rio Grande to San Pedro, on the Pacific, 831 miles, at $45,000 per mile		$37,395,000
Total from Fulton, on Red river, to San Pedro, being 1,618 miles		$68,970,000
In continuation to San Francisco, the distance from the Rio Grande at El Paso to San Fernando may be considered the same as to San Pedro, and the amount of estimate as above may be adopted. The remaining distance from San Fernando to San Francisco is about 421 miles, of which about 75 miles is of a highly favorable character of mountain passes, which may be estimated at $90,000 per mile		$6,750,000
The remaining 346 miles being estimated at $50,000 per mile		$17,400,000
Total distance from Fulton, on Red river, to San Francisco being 2,039 miles, and the total estimated cost		$93,120,000

This estimate supposes the final condition of the passes in the Sierra Nevada and the coast range. Should the steeper grades be used a reduction of nearly $3,000,000 may be made from the estimate.

The equipment for the first business of the road, included in the preceding estimate, may be estimated for 200 passengers daily each way, and a light freight business. The cost of this would amount, at eastern prices, to $1,000 or $1,200 per mile, less than one fifth of that of the six principal Massachusetts roads out of Boston, the average cost of equipment of which per mile is $6,147; total length of roads 381 miles. The amount of work performed by these roads in 1853 was—

Number of passengers carried one mile	111,075,121
Number of tons of freight carried one mile	61,858,964

Adding 50 per cent. for cost of freight, &c., we may estimate the first equipment of the Pacific road at $3,000,000, and the cost of depots, stations, &c., at from $2,500,000 to $3,000,000; total, equipment and depots, $6,000,000. Should the road be finally worked to its full power, the cost of equipment and depots would exceed $20,000,000.

The length of this route from Fulton to San Pedro is	1,618 miles.
The sum of the ascents and descents 32,784 feet, which is equivalent to 621 miles, and the equated length of the road is	2,239 miles.
The estimated cost is	$68,970,000
From Fulton to San Francisco the distance is	2,039 miles.
The sum of the ascents and descents 42,008 feet, which is equivalent to 795 miles, and the equated length of the road is	2,834 miles.
The estimated cost is	$93,120,000

BUSINESS OF THE ROAD.

It may be desirable to consider the sources of business for a railroad to San Francisco when constructed.

The value of the Santa Fé trade is stated by Captain Pope to be yearly $6,000,000.

The number of passengers to and from California is now 50,000 yearly. It will not be extravagant to assume that the road will double this number at once. This, at $200 per passenger from Fulton to San Francisco, 2,000 miles, will give $20,000,000, or, at $150 per passenger, will give $15,000,000, of which two-thirds may be assumed as profit. It is doubtful whether the present overland emigration can be counted upon as furnishing business for the road.

The light freight which is now carried by the Isthmus route, costing $394 per ton, and which, when the Isthmus railroad is completed, is to cost $169 per ton, would take the Pacific railroad route, since, allowing five cents per ton per mile for this road, the cost per ton from Fulton to San Francisco will be $105, and thence to New Orleans or Memphis, by railroad, $10 per ton additional.

Fifty millions of dollars in gold are sent annually to the Atlantic States from California. It is doubtful, owing to the nature of the risks, if the per-centage on this would accrue to the road. Two per cent., the present cost of transportation, is $1,000,000, three-fourths of which would, if carried, be the earnings of the Pacific road, $750,000.

The transportation of the mails may be set down at from $500,000 to $1,000,000.

In the year 1852–'53, 22,320,417 pounds of tea were imported into the United States, valued at $8,174,670, at a freight cost probably of $15 per ton measurement, (one-half ton weight of tea.) To supply the country west of the Mississippi we have an interior transportation, by railroad, canal, or river, of at least 1,000 miles. Freight from China to San Francisco may be assumed not to exceed $10 per ton. From San Francisco to the Mississippi river the freight on tea would be $50 per ton measurement, and the total cost of transportation would be $60 per ton measurement, against $30, brought from the eastern ports, (freight from China to Boston $15 per ton;) this, in the first instance, is six cents per pound, and in the second three cents per pound. The tea imported into the United States is of inferior quality, and, in the opinion of those familiar with the trade, would not be less injured by transportation by the railroad route than by that now used ; nor would the more delicate teas, should there be a demand for them. The earnings from this source, supposing it carried 22,000,000 pounds, would be $1,000,000.

Imports of silks from China in 1852 were valued at $1,567,912.

With the same rates of transportation as cattle are carried on the Baltimore and Ohio railroad, it would cost $36 per head to transport cattle, and $40 per head to transport horses and mules, from Fulton to San Francisco. This mode of taking cattle, horses, and mules across the continent would be only partially resorted to, and for those portions where the grazing is not good, say 500 or 600 miles, or about one fourth of the distance. Cattle driven to New Mexico or California are sold for about double the cost in Missouri and Texas, costing about $36 per head and selling for $72 per head.

To transport a barrel of flour from Fulton to San Francisco would cost from $8 to $10 per barrel, or from four to five cents per pound, (about double the cost now paid by sea to San Francisco ;) and a barrel of pork from $12 to $15, or from six to seven and a half cents per pound, and the same for provisions generally.

In the war of 1812 the transportation of all supplies cost from 50 cents to $1 per ton per mile from Albany to the frontier, say 300 miles, or from $150 to $300 per ton—the average being $225 per ton—and required from 15 to 30 days for the journey. We would be nearer therefore to our California coast, in time, by from 7 to 20 days, and at less than half the cost, were this railroad built, than we were to our northern frontier in 1812–'14.

The transportation of troops to California by the isthmus route has cost $225 for each commissioned officer and $150 for each enlisted soldier, &c., with 100 pounds of baggage each, except across the isthmus, where 25 pounds are allowed—the excess being paid for at 15 cents per pound. At present the price is $300 for each officer and $150 for each enlisted soldier.

The cost to the railroad of transporting troops from Fulton to San Francisco would be about $60 per man.

The cost to the road for freight will be about $60 per ton. The cost of transporting ordnance and ordnance stores by Cape Horn has been about $40 per ton.

The cost of transporting military stores to the posts of New Mexico from Fort Leavenworth varies from $8 to $14 per 100 pounds, or from $160 to $180 per ton. By the railroad it would cost from Fulton from $24 to $30 per ton. The cost of transporting baggage and subsistence of troops marching from Fort Leavenworth to New Mexico is about $15 per man; the time consumed about three months—the expense of the soldier during that time being from $17 to $20 per month, or $60; the cost of transportation by railroad in three days would be $50, or cost to the road from $24 to $30.

The question as to what portion of the trade between the United States and Europe, on the one side, and the empires of Japan, China, and India, on the other, together with the islands of the Pacific and Indian oceans, and the South American Pacific States, of the trade between our Atlantic and Pacific territories, and of our whale fisheries, amounting probably to $300,000,000 yearly, would be carried by the railroad from the Pacific to the Mississippi, has been so often discussed, that it is not necessary here to enter upon it. The cost of carriage of some articles has been merely touched upon to give an idea of the value of the road for military purposes. The information respecting the former and present cost of transportation of troops and military stores has been obtained from the letter of Major General Jesup, Quartermaster General of the army, to the War Department.

Whether the saving of interest on outlay of capital in trade by shortening the time of passage would be sufficient to divert a large freight business to the Pacific railroad in the most valuable articles of the trade with Asia, those more familiar with commerce than I am can determine.

The length of the road from Fulton to San Francisco may be put down at 2,000 miles; its cost at $90,000,000; its yearly earnings at $17,000,000, independent of any considerations connected with the trade of Asia, the islands of the Pacific, South America, or the whale trade.

The railroads of Massachusetts are 1,280 miles in length; have cost $60,000,000, and earn yearly $7,713,208. The yearly expense of working them is $4,541,468; their net earnings $3,211,198.

If the earnings of the Pacific railroad should be in proportion to the Massachusetts roads for outlay of capital, we should have $13,000,000 instead of $17,000,000.

But, as the equipment of the Pacific road for this business, yielding $17,000,000 yearly, is merely one-fifth that of the Massachusetts roads, the expense of working the road would be nearly in that proportion; but, as we have supposed it to be worked at double the proportionate cost of eastern railroads, (east of the Mississippi,) we have now the proportion of two-fifths, or about one-half the actual cost per mile of working the Massachusetts roads, for the probable cost per mile of working the Pacific railroad; the equipment in the latter case being one-fifth of what it is in the former. And, by this proportion, the yearly expense of working the Pacific railroad would be about $4 000,000, leaving $13,000,000 for the net earnings. This supposes 100,000 passengers yearly to and from California. Should the present number, 50,000, not increase, the yearly earnings of the road, supposing it to carry all, would be, under the suppositions expressed in the preceding page, about $10,000,000, leaving $6,000,000 for net earnings.

1. On the New York railroads, in 1853, the average cost for maintenance of way was—

For passengers	$455	per mile of road.
For freight	323	" "
Total, about	778	" "

2. The average cost of repair of machinery for each passenger carried one mile was	2.11	mills.
The average cost of repairs of machinery for each ton of freight carried one mile was	2.60	"

3. The average cost of operating the road for each passenger carried one mile was.......... 5.56 mills.
The average cost of operating the road for each ton of freight carried one mile was.......... 9.20 "
4. The average receipts from each passenger carried one mile was.......... $1\frac{3}{4}$ cents.
5. The average receipts per ton of freight carried one mile was.......... $2\frac{6}{10}$ "

Applying the above results to the Pacific railroad, the work upon which we have supposed to be at the first but one-fifth of that done on these roads, we have—

1. For passenger travel: for maintenance of roadway, if we estimate $500 per mile, it will be, under the circumstances, an estimate largely in excess, and will cover that for a light freight business. This, for 2,000 miles, is....... $1,000,000
2. The average cost for repairs of machinery, and operating the New York roads, for each passenger carried one mile, is, as above, 7.67 mills. As we have estimated the cost on the Pacific railroad at double that at eastern prices, we shall have for cost of carrying 100,000 passengers 2,000 miles......... $3,068,000

Total.......... $4,068,000

The receipts from these passengers we have put down at.......... $15,000,000

Supposing the yearly number of passengers should be only 50,000, we have from this source.......... $7,500,000
For carrying the mails.......... $1,000,000
And for transportation of troops, arms, public stores, &c., and light freight....... $1,500,000

Total.......... $10,000,000

Supposing, then, the cost of maintenance of way, repairs of machinery, and operating the road, to be, as before estimated, for double the number of passengers actually carried, we have for net earnings about $6,000,000.

The cost of carrying freight cannot be estimated at much less than three cents per ton per mile—that adopted in the previous pages.

The yearly cost of maintenance of way for freight on New York roads was $323 per mile.

The cost of repairs of machinery and operating the road for each ton of freight carried one mile, was 12 mills. Estimating the cost on the Pacific railroad at double, we have about 2½ cents for cost per mile per ton for repairs of machinery and operating the road, besides which there is the cost of maintenance of roadway.

At a railroad convention "held in New York, embracing the officers of the four great lines between the Atlantic and the West, a joint report was submitted by the superintendents of the several roads, in which they state that 'experience has proved that the lowest rates at which ordinary freight (in freight trains at a speed of 10 or 12 miles per hour, and in large quantities) can be carried to pay interest and expenses, will average about 2 cents per ton per mile for heavy agricultural products, 3 cents for groceries, and 4 cents for dry goods.' * * * Sufficient information has been elicited from the railroads of this and other States, from the action of conventions, and from other sources of information, to warrant the belief that a considerable portion of the freighting business now done by our railroads yields no profit at the present rates, when due allowance is made for the increase of capital which it requires, for the increased wear and depreciation of the works, and for the occupation of the track to the injury of the other business."—(*Report of the State Engineer, New York, January* 23, 1855.)

It appears probable, from the foregoing, that the net earnings of the road would pay a reasonable interest upon the sum required to build it. Yet, as the business of the road is to be a through business, to be found only at the two extremities, with but little way business, the capital required must be idle an average time equal to half that required for construction, which latter will not probably be less than 10 years, and the interest during that time would add from twenty-five to thirty millions to the capital. If, in consideration of the great national benefits which the construction of the road would confer, the government of the United States could lend its aid to the road so as to relieve it from the payment of interest upon the cost of the road during the time of its construction, it would seem probable from the foregoing that it might be built by private means. Without this much aid from the government, the road will probably never be built.

A donation of land, such as has been generally proposed, will be of little comparative value.

I regret that there is not time to enter a little more into these discussions.

The following extract from the annual report of the railroad corporations in the State of Massachusetts for 1852, giving the length, cost, yearly earnings, expense of working, &c., of the roads in that State, may be found interesting.

Following it is an extract from the annual report of the State engineer and surveyor on the railroads of the State of New York, showing the length, cost, &c., of the roads in that State. I have made these extracts as brief as possible. It will be seen that the estimated cost of the route of the 32d parallel, after every consideration of the unusual circumstances that will produce an increased cost, is about the same per mile as the roads in these States:

Extract from an abstract of "Annual Reports of the Railroad Corporations in the State of Massachusetts," showing totals of the leading statistics of all the roads.

Capital	$56,236,600 00
Capital paid in	46,539,220 34
Cost	60,019,051 77½
Length	1,280.29 miles.
Length of double track	270.33 "
Length of branches	103.68 "
Speed of passenger trains adopted per hour	23.63 "
Speed of freight trains adopted per hour	12.98 "
Earnings	$7,713,208 35
Expense of working	4,541,468 31½
Net earnings	3,211,197 75
Dividends	2,483,545 94
Debt	16,009,095 77
Surplus	1,112,072 95

Extract from the "Annual Report of the State Engineer and Surveyor on the railroads of the State of New York—February, 1854."

The length of all the railroads in operation in the State is	2,432 miles.
The length of railroads laid is about	2,497 "
The length of double track in addition to the above is	664 "
The number of locomotives in use is	586
The number of passenger cars in use is	834
The number of baggage and freight cars in use is	6,895
The number of miles run by passenger trains is about	6,594,963
The number of miles run by freight trains is	4,227,807
Total number of miles run	10,822,770
The whole number of miles travelled by the passengers is about	531,572,298

The whole number of miles each ton of freight was moved, or the number of tons moved one mile, is	246,554,492
The capital stock of which is about	$112,938,131 45
The capital stock paid in is about	61,238,829 22
The amount of funded and floating debt is	59,669,478 38
The amount paid for construction and equipment is	117,707,620 58

COMPARISON OF THE ROUTES.

The following table will enable a comparison to be made of the sum of ascents and descents, and the equivalent horizontal distances of the railroads connecting the Atlantic with the Mississippi, with those of the routes examined from the Pacific to the Mississippi. It will be observed, that in proportion to the lengths of the routes, the sums of the ascents and descents are less on the Pacific than on the Atlantic routes:

Roads.	Length in miles.	Elevation of summit above the sea.	Total rise and fall.	Number of miles of horizontal road equivalent in the cost of working the road to the ascents and descents.
Boston route	500	1,440	4,700	89
New York route, (Central)	440	650	2,100	40
New York route, (Erie)	460	1,720	6,500	123
Philadelphia route	340	2,400	5,600	106
Baltimore route	390	2,600 or 2,700	7,000	132
Charleston route	490	1,400	5,000	95
Savannah route	440	1,400	5,000	95

A table will be found at the conclusion of this chapter, giving some of the most important statistics of the several routes; following it, is a statement of the distances of the eastern termini of the routes to certain ports.

The sum of the ascents and descents given for the various routes does not take into consideration those minor undulations which sometimes largely increase the aggregate.

I think it probable that when detailed surveys are made, it will be found that this sum for the route near the 47th parallel will be more increased than those for the other routes, and that the sum for the route near the 32d parallel will be less increased than the others.

The equated lengths corresponding to these sums may give erroneous impressions. If the loads to be habitually carried over the roads are within the power of the engines over the greatest grades proposed, then the sums of ascents and descents really have little meaning or value. The wear and tear of rail and machinery and consumption of fuel would be somewhat greater on the road having the largest sum, but the difference would not be worth taking into account, unless there was an equality in all other respects between the routes.

If there are some grades so steep as to require the division of the loads habitually carried over other portions, the cost of the extra locomotives and of working them over those portions will show the extent of the disadvantage and yearly cost.

So far as any estimate has been made in this report of the amount of work to be done on the roads, these sums of ascents and descents have little practical value, since those portions of the routes have been indicated where it may be considered advisable to use steep natural slopes with extra engines, to expedite the completion of the road and save expensive road-bed preparation. With a full equipment and heavy freight business, the sum of ascents and descents becomes important.

The advantages and disadvantages of the several routes may be briefly recapitulated, as follows:

I. ROUTE NEAR THE FORTY-SEVENTH AND FORTY-NINTH PARALLELS.

The advantages of this route are—its low profile, which is important in relation to climate; its easy grades, and small amount of ascents and descents, both important if the road should be developed to its full working power; the great extension west of the prairie lands; in the supplies of timber over the western half of the route; the facilities which the Columbia river and its tributaries, and the Missouri, will afford to the construction of the road; in the short distance from the Mississippi to a seaport of the Pacific, (1,864 miles to Vancouver;) in the western terminus of the road on Puget Sound being nearer to the ports of Asia than the termini of the other routes; in the proximity of the eastern terminus to Lake Superior, from which a continuous navigation for seagoing vessels extends to the Atlantic ocean; and in the existence of coal on Puget Sound.

Its disadvantages are—the difficult and costly construction, including a long tunnel, through a mountain region of 550 miles, (comprising 90 miles on the Columbia river;) the delay in construction, and the liabilities of the road to great injury and destruction through a large part of this region from the high freshets on the Bitter Root, Flathead, Clark's fork, and Columbia rivers; in the severe and long winters on the prairies east of the Rocky mountains, and on the greater portion of the route suspending labor in the open air for such a large part of the year, and impeding the working of the road when built; in the distance of its western terminus from that port, (San Francisco,) which will give the only large travel, and business which may be counted upon with certainty; and, finally, its proximity throughout to the frontier of a powerful foreign sovereignty.

II. ROUTE NEAR THE FORTY-FIRST AND FORTY-SECOND PARALLELS.

Its advantages are—comparatively cheap construction, due to the favorable features of Rocky mountain system in this latitude, and those of the Great Basin, both of which result in a low sum of ascents and descents, which would be a favorable element, should the full working power of the road be developed; in the mountains being passed without tunnels; the probability of its possessing extensive coal-fields in the middle of the route; and in the aid which its construction would receive from the population of Utah.

Its disadvantages are—the very difficult and costly construction along the Sacramento river for 136 miles; the construction through the cañon of the Timpanogos; the costly construction through the Black Hills to the South Pass, for nearly 300 miles, (the route by the Cheyenne Pass apparently giving an equally costly road;) in the great elevation of the summits in the Rocky mountain system; and in the great elevation of its plain, and the long and severe winters on it, and the prairies east of the Rocky mountains, suspending labor for several months of the year, and impeding the working of the road when completed, by their severity, and the snows on the prairies and in the mountain ravines and gorges.

III. ROUTE NEAR THE THIRTY-EIGHTH AND THIRTY-NINTH PARALLELS.

No peculiar advantage was developed in the exploration of this route, except the probability of the existence of extensive coal-fields in the valleys of the Grand and Green rivers.

The extraordinary difficulties to be overcome from the Coo-che-to-pa Pass to the Great Basin (500 miles) render the route impracticable. The elevations of the passes in the Rocky mountains are the greatest found, being 9,200 and 10,000 feet, the latter, the Coo-che-to-pa Pass, requiring a tunnel at an elevation of 9,500 feet.

IV. ROUTE NEAR THE THIRTY-FIFTH PARALLEL.

The advantages of this route consist in water and fuel being generally less scanty than on the others, excepting that of the 47th and 49th parellels; in a better supply of timber west of the Rio Grande; in the greater mildness of the winter than on the routes north of it; in the temperate character of the summer over nearly the whole route; in no tunnels being required on the Rocky mountain passes, and none on the route to San Francisco by the Tah-ee-chay-pah Pass; in the probability of the existence of coal-fields in the middle of the route; and in the assistance that the population of New Mexico and the Mexican provinces of Chihuahua and Sonora may give in constructing and supporting the road.

The disadvantages are—its greater length from the Mississippi to the Pacific than the route south of it; the apparently rough and broken character of the country through which much of it lies; its much greater cost, and the greater number of ascents and descents, the sum of which is the greatest of the four routes, and which would become seriously objectionable should the full working power of the road be developed.

V. ROUTE NEAR THE THIRTY-SECOND PARALLEL.

Its advantages are—the short distance from the eastern terminus to a Pacific port (1,618 miles;) the small cost of the road, it being to a Pacific port less than two thirds of the cost of the cheapest of the other routes, and to San Francisco $20,000,000 less than the least of the others, (the cheapness of construction being due to the location of the route upon more than 1,000 miles of table-lands and plains;) in the open and otherwise favorable features of the mountain passes; the lowness of their summits; in their natural slopes admitting of use without extensive and costly preparation; in the mild winters and temperate summers of all the route except that portion of the Gila and Colorado desert where, for 350 miles, labor in the open air must be suspended for three months of the year; in there being no reason to apprehend difficulties, impediments, delays, and dangers from snow and ice; in the coal-fields of the Brazos; and in the aid that the population of New Mexico and the provinces of Chihuahua and Sonora may give in constructing and supporting the road.

Its disadvantages are—the cost of construction of a portion between the Pecos and Rio Grande; the circuitous route to San Francisco from the plains of Los Angelos, which, unless further explorations determine a more direct route, requires a second crossing of the coast range, and a passage through the Sierra Nevada; in the sum of ascents and descents being the next largest after that of the 35th parallel, the extent of which objection depends upon the amount of business to be done on the road; and, finally, in the scanty supply of water and fuel on the route.

Table showing the lengths, sums of ascents and descents, equated lengths, cost, &c., of the several routes explored for a railroad from the Mississippi to the Pacific. (For the grades, see the profiles accompanying the report.)

	Distance in straight line.	Distance by proposed railroad route.	Sum of ascents and descents.	Length of level route of equal working expense.	Comparative cost of different routes.	Number of miles of route through arable land	No. of miles of route through lands generally uncultivable, arable soil being found in small areas.	No. of square miles of sums of areas of largest bodies of arable land in uncultivable region.	No. of miles at an elevation above 0, and less than 1,000 feet.	No. of miles at an elevation greater than 1,000 and less than 2,000 feet.	2,000 and 3,000.	3,000 and 4,000.	4,000 and 5,000.	5,000 and 6,000.	6,000 and 7,000.	7,000 and 8,000.	8,000 and 9,000.	9,000 and 10,000.	Summit of the highest pass on the route.	
	Miles.	*Miles.*	*Feet.*	*Miles.*															*Feet.*	
Route near 47th and 49th parallels—																				
Route from St. Paul to Seattle.	1,410	2,025	19,160	2,367	a$140,871,000	535	1,490	b1,000	631	560	720	130	97	98	...	...	...	...	6,044	Tunnel at elevat'n of 5,219 feet.
Route from St. Paul to Vancouver.	1,435	1,864	16,100	2,207	a 130,781,000	374	1,490	b1,000	470	560	720	130	97	98	...	...	...	...	6,044	Tunnel at elevat'n of 5,219 feet.
Route near 41° and 42°, via South Pass from Council Bluffs to Benecia.	1,410	2,032	29,120	2,583	116,095,000	632	1,400	b1,100	180	170	210	160	580	225	270	107	20	..	8,373	
c38th and 39th—Westport to San Francisco by the Coo-che-to-pa and Tah-ee-chay-pah Passes.	1,740	2,080	49,986	3,125	....	620	1,460	b1,100	340	276	166	348	486	170	60	155	80	20	10,032	Tunnel at elevat'n of 9,540 feet.
38th and 39th—Westport to San Francisco by the Coo-che-to-pa and Madelin Passes.	1,740	2,290	56,514	3,360	....	670	1,620	1,100	275	395	190	143	725	284	110	153	60	20	10,032	Tunnel at elevat'n of 9,540 feet.
35th—Fort Smith to San Pedro.	1,360	1,892	48,812	2,816	d 169,210,265	416	1,476	2,300	305	347	260	185	160	305	225	85	...	...	7,472	
35th—Fort Smith to San Francisco.	......	2,174	50,676	3,137	....	644	1,530	2,300	....	....	....	....	...	...	...	...	..	..	......	
32d—Fulton to San Pedro.....	1,400	1,618	32,784	2,039	68,970,000	408	1,210	2,300	485	300	100	170	503	60	...	...	...	...	5,717	
Fulton to San Francisco.	1,620	2,039	42,008	2,834	93,120,000	756	1,290	2,300	700	415	160	265	504	60	...	...	...	...	5,717	

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a These are the estimates of the office, those of Gov. Stevens having been brought to the same standard of increased cost as the other routes, and his equipment reduced to that of the other routes. His estimates were $117,121,000 and $110,091,000.

b These sums do not include the areas of cultivable soil as far west as the Cascade and Sierra Nevada mountains.

c Supposing the route to be a straight line, with uniform descent from the Un-kuk-oo-ap mountains (near Sevier river) to the entrance of the Tah-ee-chay-pah Pass—the most favorable supposition.

d This estimate for the route near the 35th parallel is thought to be largely in excess.

The sum of the minor undulations (not included in the sum of ascents and descents here given) will probably be greater for the route of the 47th parallel than for the other routes; that for the route near the 32d parallel will probably be the least of all.

With the amount of work estimated for the roads in this report, the equated lengths corresponding to the sum of ascents and descents has but little practical value. With a full equipment and heavy freight business, the sum of ascents and descents becomes important.

Distances of the eastern termini of the several Pacific Railroad routes to the Mississippi river, Boston, New York, Charleston, and New Orleans, by railroad built, building, and projected, as measured on the "Railroad maps."

		Miles.
1. St. Paul	to Boston	1,316
	to New York	1,190
	to Charleston	1,193
	to New Orleans	1,198
2. Council Bluffs	to Rock Island (Miss. river)	267
	to Boston	1,374
	to New York	1,252
	to Charleston	1,195
	to New Orleans	1,075
3. Westport, mouth of Kansas, (near Fort Leavenworth)	to St. Louis, (Miss. river)	245
	to Boston	1,415
	to New York	1,220
	to Charleston	1,045
	to New Orleans	875
4. Fort Smith, on the Arkansas,	to Memphis, (Miss. river)	270
	to Boston	1,540
	to New York	1,345
	to Charleston	960
	to New Orleans	655
5. Fulton	to Gaines, (Miss. river)	150
	to Boston	1,530
	to New York	1,335
	to Charleston	950
	to New Orleans	402

CHAPTER VI.

NOTES BY LIEUTENANT G. K. WARREN, TOPOGRAPHICAL ENGINEERS, ON THE ROUTE FROM INDEPENDENCE TO SANTA FE, AND FROM INDIANOLA, VIA SAN ANTONIO, TO EL PASO.—(Compiled from the Reports of Lieut. Col. Johnston, Top. Engrs., Lieut. Smith, Top. Engrs., Capt. S. G. French, 3d Regt. Arty., and others.)

It will be seen from the results of the late explorations, that there are two practicable passes by which to reach, from the east, the New Mexican population of the Rio Grande valley, viz: by the passes near Santa Fé and by El Paso. As regards grade, a practicable route exists for connecting the former of these passes with Independence and St. Louis, (by the Cimarron route,) and probably a practical connexion of El Paso with San Antonio, or a part of the Gulf of Mexico.

The following notes relate to these two routes:

1st. Route from Independence to Santa Fé.—From Independence, Missouri, in latitude 39° 7′, longitude 94° 26′, to Santa Fé, in latitude 35° 41′, longitude 106° 01′, was barometrically surveyed by Dr. Wizlizenus in 1846, and the following notes are mainly from his report.

It is very direct, and lies mostly on a table-land gradually ascending towards the west, where little difficulty need be apprehended in obtaining easy grades. Its length is 765 miles.

From Independence to Council Grove, a distance of 143 miles, the route passes through a well-watered fertile prairie, which resembles the sea in its gentle undulations. There is sufficient wood along the water-courses to supply the railroad with ties and fuel. Westward the country undergoes a change, becoming gradually more sandy and barren, until we reach the Arkansas, a distance of about 200 miles. It still preserves its wave-like character, and can only be settled by a pastoral people.

The Arkansas is broad and shallow, with a sandy bottom. It has low bluffs or none at all. It is sometimes bordered with cotton-wood, but is generally quite bare. From this uninviting river to the lower springs of the Cimarron, a distance of 66 miles, the route lies over a barren, level desert, elevated 3,000 feet above the sea. It is scantily supplied with parched buffalo-grass; but is entirely without water, wood, or even buffalo-chips, the usual fuel in such inhospitable regions.

The lower springs of the Cimarron form a little green oasis with running water. From this point to Cold Spring, a distance of 80 miles, the desert character of the country continues. Water is sometimes found in the Cimarron river; but often it can only be obtained by digging in its dry and sandy bed. The want of it has often occasioned much loss and suffering in this barren wilderness.

From Cold Spring to the Canadian river, a distance of 110 miles, the route approaches and skirts a spur of the Raton mountains. Its character rapidly improves. The mountains are covered with cedar and pine forests, furnishing an ample supply for railroad purposes. The valley of the Canadian is fertile, and well adapted to settlements.

From this point to Galinas, a distance of 60 miles, the trail passes over an elevated plain nearly surrounded by mountains. The valleys of the streams are fertile. Water is abundant, and the mountains are thickly wooded with pine.

From Galinas, Dr. Wizlizenus says, "we shall now travel mostly in narrow valleys, and through mountain passes surrounded by high precipitous rocks." As he did not survey the route for a railroad, his information is not sufficiently definite to determine whether it is practicable for this purpose. Near this point it should, therefore, be considered as joining that of Lieutenant Whipple.

2. *From Indianola, via San Antonio, to El Paso.*—A route for a railroad has been surveyed and located between Indianola and San Antonio. It crosses the Guadalupe river at Victoria, about 30 miles from Indianola. Thence to San Antonio is about 100 miles.

A route was surveyed, barometrically, from San Antonio to Frontera by the Mexican boundary commission, and the profile was furnished to the Pacific railroad office, by Brevet Major Emory, of the topographical engineers, the distances being taken from the report of Colonel Johnston, topographical engineers. This profile gives the elevations along the route travelled, where the object was more to find good pasturage and water for the animals than to obtain easy grades. It, therefore, is only valuable as showing the general elevation of the country.

From San Antonio, the travelled road keeps along the foot of the hills, near the parallel of 29° 20′, as far west as the San Pedro or Devil's river, longitude 101°. It then ascends that stream 60 miles, and crosses over to the Pecos, and ascends this to the parallel of 31° north. It then proceeds west over the plains to El Paso, crossing the mountainous belt of country forming the continuation of the Guadalupe mountains on the north, the greatest elevation attained being 5,766 feet in the Wild Rose Pass of the Diabolo mountains.

Colonel Johnston undertook to explore a route north of this pass, and more directly west, but found it impracticable. Lieutenant Garrard, under orders from Captain Pope, explored this range about 30 miles south of the Guadalupe Pass without finding one more practicable: so there now remains but about 40 miles of these mountains unexplored.

There would probably be no difficulty of grade in continuing up the Pecos to the mouth of Delaware creek, and connecting with the route surveyed by Captain Pope in 1854, through the Guadalupe and Hueco mountains. This latter is usually known as the upper or northern, the former as the lower or southern El Paso routes. Distance from Indianola to Fort Fillmore, by the upper road, 820 miles; by the lower, 840 miles.

The lower route was first explored by W. H. C. Whiting, Corps of Engineers, and Lieutenant W. F. Smith, topographical engineers, in 1849; and subsequently surveyed by Colonel Johnston, who was followed by Captain S. G. French, of the quartermaster's department, in charge of a large train.

The upper route was first explored by Lieutenant Bryan in 1849, afterwards by Captain Marcy; was surveyed by Colonel Johnston in 1849, and again surveyed by Captain Pope in 1854, who added to our previous knowledge by giving us a profile. That route from the mouth of Delaware creek to El Paso forms part of the railroad route near the 32d parallel.

The following notes concerning the lower route are taken mainly from the report of Captain French, the distances being from Colonel Johnston's report:

From San Antonio to Rio San Felipe, 160 miles, most of the soil is excellent for agriculture or grazing. Wood is abundant on the banks of the streams. The road through this extent crosses numerous streams, some of which when swollen by rains are "large rivers." There is, however, sometimes a deficiency of water, particularly on the Rio Seco and Rio Frio. Bituminous coal is said to exist in abundance on the Nueces, 90 miles from San Antonio.

After leaving the San Felipe, a marked change takes place in the face of the country. Before reaching it, in the vicinity of 100° meridian, the surface becomes more rolling and hilly, and less covered with trees; and by the time we reach the San Pedro, on the 101st meridian, it is nearly barren. The valley of the San Pedro varies from a quarter to half a mile in width, and, owing to its vertical sides, it is difficult to approach. Much of the way it is very rough, and the road along it frequently takes the bed of the stream, and is in places submerged by the autumn freshets at least 20 feet. The travelled route usually avoids the lower part of the valley, keeping to the west of it.

After leaving the San Pedro, the first reliable water is 40 miles distant, at Howard's spring, 271 miles from San Antonio. The next at Live Oak creek, 304 miles from San Antonio. Afte crossing this creek the route follows it to the Pecos, and up this to the crossing. This portion of the Pecos is "narrow and deep, extremely crooked in its course, and rapid in its current. Its waters are turbid and bitter." * * * "Its banks are steep, and of clay. In a course of two hundred and forty (240) miles there are but few places where an animal can approach them for water with safety. Not a tree or bush marks its course."

The road crosses the Pecos 348 miles from San Antonio. It then proceeds west to the Escondido springs, 27 miles; thence to Comanche springs, 19 miles—(clouds of suffocating dust accompanied the passage of the train;) thence to Leon springs, 10 miles; thence to the Limpid, 37 miles. The country from the Pecos to this point, 93 miles, is exceedingly sterile, and, except a little cane and coarse grass about the springs and the mezquite, is barren; but it is favorable for grades. At the Limpid we enter the region of the Diabolo mountains, probably a continuation of the Guadalupe range. The country is beautiful, and the mountains in August were covered with green grass to their summits. Pine is found on them. The pass is called the Wild Rose Pass.

These mountains do not form a single continuous ridge, but are made up of single conical peaks, intersecting each other so as to form "an impassable barrier" had not some convulsion of nature seemed partly to have opened the pass and cañon through which the road runs. The cañon is deep and narrow, and in some places not more than 200 yards wide. The last encampment on the plain to the east is at the Painted Camp, 463 miles from San Antonio. We leave the mountains about 40 miles farther on and come upon an elevated plain with water in very limited quantities. Over this plain the road passes for 60 miles to Eagle springs. From Eagle springs the route leads by a cañon through the mountains on the left, and reaches the Rio Grande in a distance of 31 miles; thence to Fort Fillmore, 119 miles; making a total distance from San Antonio of 710 miles, and from Indianola 840 miles.

No reliable practical result could be obtained by the application of the equation of grade to the ascents and descents on this route according to the profile we have.

The elevations are: at Indianola, 0 feet; at San Antonio, about 700 feet; at leaving of Pecos, 1,900 feet; at summit of Wild Rose Pass, 5,766 feet; at Van Horner's well, 4,146 feet; on the mountains to the west, 4,714 feet; at first reaching the Rio Grande, 3,536 feet; at Fort Fillmore, 3,938 feet. Some of the grades are, for short distances, as high as 400 to 500 feet per mile, but could, no doubt, by proper location, be reduced to practicable ones. No wood could be relied on for railroad purposes from the San Felipe to the Diabolo mountains, a distance of 330 miles; probably none to the west of these mountains.

Water for working parties and for the use of the locomotives could probably be obtained as easy as on corresponding portions of the route of the 32d parallel.

MEMORANDA ON RAILWAYS,

PREPARED IN THE

OFFICE OF PACIFIC RAILROAD SURVEYS;

BY

CAPT. GEO. B. McCLELLAN,
CORPS OF ENGINEERS,

UNDER INSTRUCTIONS FROM

HON. JEFFERSON DAVIS, SECRETARY OF WAR.

MEMORANDA ON RAILWAYS.

WASHINGTON, D. C., *November* 21, 1854.

SIR: I have the honor to submit the accompanying memoranda upon various practical points connected with the construction, &c., of railways.

For the information therein contained I am chiefly indebted to Col. C. Crozet, Messrs. W. Raymond Lee, William P. Parrot, J. Edgar Thompson, and William Parker, civil engineers, who most kindly afforded me all the assistance I asked.

The article on tunnels is taken principally from a paper by Mr. W. L. Dearborn, civil engineer.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieutenant Engineers and Brevet Captain.

Hon. JEFFERSON DAVIS,
Secretary of War.

GRADIENTS.

The following gradients are now, or have been, in use on American railways:

During the construction of the *Baltimore and Ohio* railroad a gradient of 528 was used on a temporary track, en boyau, merely to transport small loads of iron, &c. On the *Virginia Central* road the trains pass every day over a gradient of 275 feet—length two miles. On a part of this are curves of 300 feet radius (19° 6′) on a grade of 238 feet; 40 tons have been carried up this by a 30-ton engine on six drivers, with the utmost ease. Brakes of a peculiar construction are used, and found to answer well. On the "Virginia Central" the trains ascend at a velocity of about seven miles per hour, and descend at an average velocity of about four miles. In descending the steam is cut off and the wheels of the engine allowed to revolve, the brakes on the cars being "hard down." Reversed curves are frequent and sharp. On the *Baltimore and Ohio* road are grades of 116 feet for 17 miles. Auxiliary power is here employed, the trains being divided, and running up at the rate of 15 miles per hour. The trains descend these grades with a velocity of 25 miles under perfect control.

On the *Pennsylvania Central* road there are gradients of 95 feet for 9½ miles; where curves occur the grade is reduced at the rate of 0.025 per 100 feet per degree of curvature. Passenger trains ascend this grade with a velocity of 24 miles per hour, and descend at 20 miles per hour. The ascent, when there are more than three cars, is effected by the aid of an additional engine. The working load of the heavy freight engines (weighing 65,000 pounds, and on eight drivers) on the 95-feet gradient is 125 tons net, or about 208 tons, including tender and cars. Over the 53-feet grades on this road (Pennsylvania Central) the general load of the engines (55,000 pounds, on six drivers) is 150 tons net, or about 250 tons, including tender and cars. On the *Massachusetts Western* road are grades of 83 feet for 1½ mile. Engines of 20 tons draw 100 tons over this grade. Passenger trains run up at about 18 miles per hour without auxiliary power. The average amount of wood consumed and cost of haulage, on the *whole* road, are no greater than upon other Massachusetts roads of lighter grades.

It is the opinion of many able railway engineers that, on a permanent track, grades of 200 feet, and even of 250 feet, may be advantageously overcome by locomotive power; it being clearly understood that such grades are to be resorted to only in cases of absolute necessity—economy in working the road rendering low gradients very desirable.

The accompanying formulæ and their applications show what work is to be expected from any given engine over given grades, and make the loss of economy in any particular case a question of easy solution.

It is evidently the fact that there is at present a strong tendency to use much higher grades than were formerly considered practicable or advisable. Even in England and on the "Continent," the American system of cheap roads, with high grades, to avoid the great expense of long tunnels, deep cuts, and high embankments, appears to be, to a certain extent, rapidly rising in repute.

The use of *inclined planes* with *stationary* power, (within the limits before mentioned,) may, as a general rule, be considered obsolete, except in cases similar to that of the Pennsylvania Central road, where the amount of traffic is becoming so great as to require more than a double or even triple track; in this case it has been proposed to pass the *surplus freight* over the mountains by means of stationary power, reserving the locomotive power for passengers and freight requiring rapid transportation.

Planes for stationary power should not exceed one mile in length. The number required to overcome any given ascent will depend more upon the elevation to be surmounted than the *length* of the ascent.

The opinion has been expressed by one of the most reliable railway engineers in the country, that where the gradient does not exceed 132 feet per mile, locomotive is cheaper than stationary power, without reference to the element of the first cost of grading for the two plans of operating the road; also, that the difficulty and danger in descending high grades is more important in determining their inclination than the resistance in their ascent.

In estimating the loss of economy of power in overcoming high gradients, the comparison should be made between the loads *habitually* drawn over the *more favorable* portions of the road, and the *maximum* load that *can be* drawn over the gradient in question.

FORMULÆ.

To obtain the maximum load due any engine of given weight, upon a given grade, and to obtain the maximum grade up which an engine of given weight can draw a given load:

$$\left.\begin{aligned} (1)\ x &= \frac{0.2\mathrm{A}}{0.4242f + 8} \\ (2)\ f &= \frac{0.2\mathrm{A} - 8x}{0.4242\,x} \end{aligned}\right\} \text{The engine and rail being in good order.}$$

$$\left.\begin{aligned} (3)\ x &= \frac{0.143\mathrm{A}}{0.4242f + 8} \\ (4)\ f &= \frac{0.143\mathrm{A} - 8x}{0.4242\,x} \end{aligned}\right\} \text{The rail being in bad order, slippery, greasy, \&c.}$$

In these formulæ, A represents the adhesive weight of the engine; that is to say, the portion of the weight of the engine actually supported by the drivers; it is expressed in pounds. In engines with four drivers about 0.6 of the whole weight of the engine rests upon the drivers, sometimes as high as 0.67; 0.64 may be taken as the average. With six drivers the whole weight of the engine will rest upon them, and, consequently, be the value of "A."

"f" is the grade in feet per mile.

"x" is the load drawn, including tender, and is expressed in tons.

Formulæ (2) and (4) are simply deductions by transposition from (1) and (3.)

In formulæ (1) and (3) the numerator expresses the *effective* adhesive weight; that is to say, it expresses the portion of the total adhesive weight which is found by experiment to be really effective in drawing a load in certain states of the rail. Now, since we know by experiment that on a level a force of eight pounds is necessary to draw one ton, if we divide the effective adhesive weight (expressed in pounds) by 8, the quotient will be the load due that effective adhesive weight, and formula (1) will read $x = \frac{0.2\,A}{8}$.

On a grade we know that, in addition to the force necessary to overcome the friction, it is also necessary to apply further power to counteract the effect of gravity.

Taking a load of one ton, and calling "f" the height of the plane, "l" the *length*, (for the value of which we may, in the slight inclinations given railway grades, substitute the value of the *base* of the plane, without appreciable error,) we have for the tendency of one tōn to move down the plane $\frac{2240\ x\ f}{l}$, or substituting for l, 5280, the number of feet in a mile $\frac{2240\ x\ f}{5280} = 0.4242 f$, "$f$" being the height in feet of a plane whose base is one mile long.

This expression ($0.4242\ f$) is, then, the measure of the force required to prevent one ton from sliding down the plane, and must be added to the force necessary to overcome the friction of a ton on a level in order to obtain the force required to keep one ton in motion up a grade.

Dividing, then, by this sum ($0.4242 f + 8$) the disposable power of the engine (0.2 A,) we have the number of tons that the engine can draw up any given grade.

Engines usually weigh from 20 to 24 tons; some as much as 30 tons: it is considered desirable to reduce the weight of engines as much as possible, in order to diminish the wear and tear of the rails.

Most engines now run with four drivers—the front of the engine resting upon a truck with eight small wheels; some engines, particularly those intended for heavy grades, are placed upon six wheels, all drivers, in order to increase the effective adhesive weight. The objection to multiplying the number of drivers consists in the increased number of joints, &c., with the consequent increase of friction and loss of power.

A common 8-wheel tender weighs, empty	14,000	lbs.
Water for 25 miles, (12,000 gallons at 8.35 lbs. per gallon)	10,437	"
Wood, (1.44 cord, at 3,180 lbs. per cord)	4,579	"
4 passenger cars, for 50 passengers each, at 12,000 lbs. each	48,000	"
2 baggage cars, at 16,000 lbs.	32,000	"
200 passengers, at 150 lbs. each	30,000	"
Baggage, at 100 lbs. each passenger	20,000	"
Add for contingencies	12,224	"
Total weight of train of 200 passengers	171,240	"

or 76 tons.

We will now take a 20-ton engine on four drivers and apply the formula.

The total adhesive weight will be about	28,600	lbs.
Its maximum load on a level, over a good track	715	tons.
Its maximum load on a level, over a track in bad condition, slippery, &c.	511	"
By formula (2) we have for the same engine the maximum grade up which it can draw the train of 200 passengers, as given in detail above	$159\frac{3}{4}$	feet.
By formula (4) we have for same data a maximum grade of	109	"

By formula (1) we have the maximum load of same engine up a grade of 150 feet	79	tons.
By formula (3) for same data we have a maximum load of	56¾	"
For a 20-ton engine on six drivers:		
The total adhesive weight will now be	44,800	lbs.
By formula (2) we have the maximum grade up which it can draw a load of 76 tons	261	feet.
By formula (4) a maximum grade of	181	"
By formula (1) with same data we have for a grade of 150 feet a maximum load of	124	tons.
By formula (3) with same data, a maximum load of	89	"
For a 22-ton engine on four drivers:		
The total adhesive weight is about	31,500	lbs.
By formula (1) maximum load on level	787½	tons.
By formula (3) maximum load on level	563	"
By formula (2) the maximum grade up which it can draw a load of 76 tons is	178	feet.
By formula (4) it is	122	"
By formnla (1) the maximum load that this engine can draw up a 150 feet grade is	87	tons.
By formula (3) it is	62½	"
For a 22-ton engine on six drivers:		
The total adhesive weight is	49,280	lbs.
By formula (1) the maximum load on a level is	1,232	tons.
By formula (2) the maximum grade up which it can draw a load of 76 tons is	289	feet.
By formula (4) the maximum grade for same load is	201	"
By formula (1) the maximum load this engine can daw up a grade of 150 feet is	137	tons.
By formula (3) the maximum load for 150 feet grade is	98	"
For a 24-ton engine on four drivers:		
The total adhesive weight is	34,406	lbs.
By formula (1) the maximum load on a level is	860	tons.
By formula (3) the maximum load on a level is	615	"
By formula (2) the maximum grade up which this engine can draw a load of 76 tons is	196	feet.
By formula (4) the maximum grade for 76 tons is	135	"
By formula (1) the maximum load this engine can draw up a grade of 150 feet is	95	tons.
By formula (3) the maximum load for same grade (150 feet) is	68⅓	"
For a 24-ton engine on six drivers:		
The total adhesive weight is	53,760	lbs.
By formula (2) the maximum grade up which this engine can draw a load of 76 tons is	317	feet.
By formula (4) the maximum grade for same load is	221	"
By formula (1) the maximum load this engine can draw up a grade of 150 feet is	149	tons.
By formula (3) the maximum load up same grade is	106½	"
By formula (1) the maximum load this engine can draw up a 200-feet grade is.	115½	"
By formula (3) the maximum load up same grade is	83	"
By formula (1) the maximum load up 275 feet grade is	86¾	"
By formula (3) the maximum load up same grade is	62	"
For a 30-ton engine on four drivers:		
The total adhesive weight is	43,008	lbs.
By formula (1) the maximum load on a level is	1,075	tons.

By formula (3) the maximum load on a level is	770	tons.
By formula (2) the maximum grade for load of 76 tons is	250	feet.
By formula (4) the maximum grade for 76 tons is	173	"
By formula (1) the maximum load up a grade of 150 feet is	119½	tons.
By formula (3) the maximum load for same grade is	85	"
By formula (1) the maximum load on a 200-feet grade is	93½	"
By formula (3) the maximum load on a 200-feet grade is	67	"
For a 30-ton engine on six drivers:		
The total adhesive weight is	67,200	lbs.
By formula (1) the maximum load on a level is	1,680	tons.
By formula (2) the maximum grade up which this engine can draw a load of 76 tons is	401	feet.
By formula (4) the maximum grade for the same load is	281	"
By formula (1) the maximum load this engine can draw up a grade of 150 feet is.	186	tons.
By formula (3) the maximum load for same grade is	133½	"
By formula (1) the maximum load for grade of 200 feet is	146	"
By formula (3) the maximum load for the same grade is	104½	"

CURVES.

On the Virginia Central road there are curves of 300 feet radius on a grade of 328 feet per mile.

On a level, trains run on curves of 300 feet radius at a velocity of 20 miles per hour.

A radius of 150 feet, and even less, is practicable; but in such cases the velocity of the train must be greatly diminished.

There are various formulæ for the calculation of the resistance on curves, but the simple inspection of a wheel that has been some little time in use will show the inaccuracy of the results. The formulæ are based upon the supposition that the surface of the tire is conical; this shape is soon destroyed by what is called the channeling of the wheel.

The resistances in question can probably be determined only by the result of many experiments with a dynanometer.

On the Pennsylvania Central road the grade is reduced on curves at the rate of 0.025 per 100 feet per degree of curvature.

CONSTRUCTION.

To lay the rails.—The road-bed being prepared, cross-ties placed, and iron distributed, a party of six men will lay half a mile of track per day.

The cross-ties should be prepared with corrosive sublimate; the sulphurets do not answer a good purpose. 20,000 spruce cross-ties were prepared in this way, and laid in 1840; they are now perfectly sound, although the natural duration of the wood is but *five* years. Cross-ties average about twenty-five cents each.

Shallow excavations may be covered with workmen. In the case of *deep excavations*, where the earth cannot be removed laterally, sections of one-half mile, worked from both ends, are usually most advantageous; this distance, however, will depend chiefly upon the relation between the established gradients and the natural surface of the ground. The end of a cut composed of loose gravel or sand will accommodate a force capable of moving 15 to 20,000 yards in a month. In one case, 26,000 cubic yards of sand were moved in that time, the average haul being three-quarters of a mile.

Long, deep cuts of gravel, sand, or similar deposite, can be opened, (working two levels at each end,) with an average haul of one mile, at the rate of 15,000 to 25,000 cubic yards in 26 days.

Ordinary gravel can be dug, thrown into a car, and moved an average haul of 1,000 feet for

12 cents to 14 cents per cubic yard; for every additional 100 feet add a third of a cent. One man shovels into a car 15 yards to 18 yards per day.

STATEMENT OF WEIGHTS, COST, &C.

Locomotives weigh from 12 tons to 30 tons, generally from 20 tons to 24 tons. They cost from $5,000 to $8,500, freight-engines being rather more expensive than passenger-engines. This includes the cost of an ordinary eight-wheel tender.

A tender on sixteen wheels, carrying about 2,500 gallons of water, will weigh about 28,000 pounds empty.

A tender on eight wheels, of 1,250 to 1,500 gallons capacity, weighs 14,000 pounds empty.

A tank on eight wheels, holding 3,000 gallons water, will weigh less than an eight-wheel tender, and cost $650.

A tank on six wheels, of 2,500 gallons capacity, costs $550.

Baggage-cars generally weigh 16,000 pounds, and cost $1,200.

Passenger-cars for 50 passengers weigh 12,000 pounds, and cost $2,000.

Passenger-cars for 75 passengers weigh 14,000 pounds, and cost $2,500.

Freight-cars on eight wheels weigh 14,000 pounds, cost $650, and are of about eight tons to ten tons capacity.

Passengers are usually allowed from 50 pounds to 80 pounds of baggage each.

The weight of passengers may be estimated at 150 pounds each.

On the New England roads the average cost of the transportation of freight is 1½ cent per ton per mile.

The transportation of passengers costs about 1½ cent each per mile.

This is the average of the actual running cost, and does not cover depreciation of the road; to provide for this, and to secure a fair profit, it is generally stated that the freights and fares charged must be double the amounts given above.

In Massachusetts the average cost of *repairing locomotives* is (per annum) 6½ cents per mile run. For repairing tracks, exclusive of iron renewals, 11½ cents.

The average durability of iron in Massachusetts is not more than ten years. Old rails are re-rolled at a cost of $25 per ton; the ends may be rewelded for $5 per ton. In this connexion it may be remarked that the ends of the rails first give way, as a general rule; they are repaired by cutting off the injured part of the upper flange and welding on a piece of "Swedes" bar-iron. Small injuries in the middle part of the rail may be repaired, economically, in the same manner.

The average waste of steam while engines are at rest, stopping on the road, steaming up, &c., is one-third of the whole amount generated.

In Massachusetts, engines usually run with a pressure of 100 pounds in the boiler. The strength of the boiler is from 350 to 500 pounds.

Rails are now rolled from 18 feet to 23 feet in length; on the New England roads they average about 60 pounds to the yard; 90 pounds to the yard is recommended by many engineers as the proper weight for the Pacific railway.

A cast-iron wheel of the ordinary size will safely bear a weight of 1½ ton.

BRIDGES.

The railway wooden-truss bridges cost from $30 to $35 per running foot.

200 feet has been found to be about the maximum length that it can safely have; many engineers prefer reducing the spans to 50 feet.

Iron bridges have been successfully and economically used on some railways, and cost $40 per foot.

Many engineers prefer, whenever it is possible, using culverts and high embankments to the employment of bridges, as being the safer and more economical plan. This course has been adopted with embankments as high as 160 feet.

WATER AND FUEL.

The capacity and weight of tenders and tanks will be found on page 120.

To supply a passenger train, of 200 passengers, for 25 miles, under ordinary circumstances of track, &c., there will be required, of—

Water	1,250 gallons.
Wood (such as pine)	1.44 cord.
Or of coal (anthracite)	0.64 ton.
Or of coke	0.62 ton.

To supply same train 100 miles—

Water	5,000 gallons.
Wood	5.76 cords.
Or coal (anthracite)	2.56 tons.
Or coke	2.48 tons.

The quantity of anthracite as given above is on the supposition that the train makes no long stops; in that case, the amount would have to be increased.

The average of six trips on the *Boston and Maine* railway gives the following result:

A load of 170.5 tons (weight of cars and freight, exclusive of engine and tender, in tons of 2,000 pounds) was drawn 74 miles, at a velocity of 14.5 miles per hour, with an expenditure of 4,654.5 pounds of anthracite, and 3,348 gallons of water.

The average of eight trips gave as a result that 10.59 pounds of anthracite evaporate 7.48 gallons of water, or 0.78 ton to 1,250 gallons of water.

The trip with *Cumberland* coal indicated that 9.19 pounds of it will evaporate 7.48 gallons (1 cubic foot) water, or 0.64 ton to 1,250 gallons of water.

On the same road the average of ten trips results as follows:

A load of 210 tons (as above) was drawn 74 miles, at a velocity of 14.1 miles per hour, with an expenditure of 3.4 cords of wood, and 3,734 gallons of water.

These experiments were conducted in the winter season, and the track was more or less obstructed by snow and ice, giving a very unfavorable state of the rail.

1 cord of beech	evaporates	1,621	gallons water.
1 cord of spruce	"	1,200	"
1 cord of hemlock	"	1,028	"
1 cord of pitch-pine	"	994	"
1 cord of white-pine	"	906	"

Cotton-wood can be used, but is one of the least valuable species of timber as a steam-generator per pound; and its specific gravity is very low.

The result of a year's work on the Central road of Georgia shows that *one cord* of wood was used for every *sixty-six and four-tenths* miles on the road.

As pine wood is corded on the tender, one cubic foot will evaporate one cubic foot (7.48 gallons, or 62½ pounds) of water.

One cord southern pine weighs 3,180 pounds.

One cord common dry pine weighs 2,616 pounds.

For passenger trains the water stations are usually about 25 miles apart.

For freight trains 12 to 15 miles is found a convenient distance for replenishing the supply.

Over ordinary grades, say 30 feet to 40 feet, there would be no difficulty in carrying water and fuel for 100 miles, either by using additional tenders, or large ones made for the especial case, or tanks; the weight, &c., of these being given, it becomes a simple matter of calculating the extra weight to be drawn in any given case.

A partial remedy would be to condense the exhaust steam. This has been done in Scotland to a certain extent.

In ascending heavy grades water is required oftener than usual. Thus on the heavy grades of the Baltimore and Ohio road (116 feet) water is taken every eight miles; on the Western Massachusetts road the water stations are 10 to 12 miles apart on the heavy grades. It is to be remarked that on this road the average consumption of wood is not greater than on others of less heavy grades.

When the track is obstructed by snow it becomes necessary for the passenger trains to take in wood and water oftener than usual, using about double the ordinary amount.

STATISTICS OF VARIOUS RAILROADS.

Boston and Worcester road.

Length, 45 miles; maximum grade, 37½ feet; minimum radius, 541 feet. This distance is accomplished, by trains of four to six passenger cars, in 1½ hour; consuming 1¼ cord of wood, and evaporating 1,200 gallons of water; water is taken once on the road.

Freight trains with maximum loads take water every 12 to 15 miles.

An engine has run, with a train, from Boston to Worcester and back (90 miles) with one cord of wood.

Boston and Providence road.

Length, 43½ miles; maximum grade, 37½ feet.

Trains of four to six passenger cars run at a velocity of 25 miles an hour, maintaining the same up the maximum grade; they consume 3,500 pounds of wood, and evaporate 10,000 pounds of water; take water once on the road, but no wood.

Freight trains as on Worcester road.

In severe snow-storms passenger trains drawn by two or more engines take water every 12 to 15 miles.

Pennsylvania Central road.

Passenger trains wood and water at from 20 to 30 miles; freight trains at an average of 10 miles.

Boston and Maine road.

Trains of four to seven cars at velocities from 24 to 34 miles per hour; take water every 20 miles.

Boston and Lowell road.

Length, 26 miles.

Passenger trains pass over this distance in one hour; take neither wood nor water; evaporate 1,100 to 1,200 gallons, and consume three fourths of a cord of pine.

Freight trains carrying maximum loads due the engine take water once on the road, and travel with velocity of 12 miles per hour.

Burlington to Rutland.

Distance, 67 miles.

Passenger trains take wood and water once; freight trains take wood and water four times.

Rutland to Bellows Falls.

Distance, 53 miles; maximum grades, 60 feet.

Neither wood nor water is taken on the road in passenger trains. Velocity up maximum grade, 15 miles per hour.

With reference to the transportation of coal to be used as fuel, it may be stated that the freights by canal in New York and Pennsylvania vary from $1\frac{2}{10}$ to $1\frac{7}{10}$ cent per ton per mile; that the railroad freights on coal average about 1½ cent per ton per mile; and, finally, that in Pennsylvania, under very favorable circumstances, coal can be delivered on the canal-boats, at the mine, broken, screened, and weighed, at 55 cents per ton. Taking the average weight of hard wood fit for generating steam at 1½ ton per cord, the probable expenses of transporting it by railway would be 2¼ cents per cord per mile.

The experiments before alluded to on the Boston and Maine road show that 1 ton of anthracite $=1.6$ cord of wood (such as used there;) or one cord of wood $= 0.625$ ton of coal, taking evaporating power as the standard of comparison. The general result of these experiments was that coal is more economical, especially with heavy loads, than wood.

The presence of metallic salts in water is injurious to the boilers; if in large quantities, they are prohibitory.

From the data given above, it would seem that the cost of transportation of wood for fuel would be about 2.4 times that of coal for the same purpose.

It will be remarked that freight trains habitually take water oftener than passenger trains; this arises from two principal causes: first, more steam is wasted in freight trains, on account of the great detentions, &c., as well as other causes; secondly, the various water-stations seldom give sufficient water to afford a *full* supply to several trains; a little is, therefore, taken from each, so that no one need be exhausted.

Relations between weight of water and fuel, and maximum load of engine.

For a 22-ton engine on 4 drivers, on a level:

Weight of water and wood for 25 miles $= \frac{1}{84}$ of maximum load of engine.
Weight of water and wood for 100 miles $= \frac{1}{22}$ of maximum load of engine.
Weight of water for 100 miles and wood for 200 miles $= \frac{1}{18}$ of maximum load of engine.
Weight of water and wood for 200 miles $= \frac{1}{16}$ of maximum load of engine.
Weight of water and coal for 25 miles $= \frac{1}{105}$ of maximum load of engine.
Weight of water and coal for 100 miles $= \frac{1}{26}$ of maximum load of engine.
Weight of water for 100 miles and coal for 200 miles $= \frac{1}{23}$ of maximum load of engine.
Weight of water and coal for 200 miles $= \frac{1}{13}$ of maximum load of engine.

The maximum load of this engine, on a grade of 40 feet per mile, is by formula (1) 252 tons; by formula (3) 180 tons.

The relative consumption of fuel and water on passenger and freight trains is in proportion to the resistance to be overcome, and may be determined when the velocity and weight of each train are known.

CHARACTERISTICS AND COST OF SIX RAILWAYS.

1. *Massachusetts Western road.*

Length of main road, 155½ miles, of which 53 miles is double track; sidings, &c., 8½ miles: equivalent to 217 *miles single track.* Maximum grade, 83 feet for 1½ mile; total rise and fall, 2,085 feet; minimum radius of curvature, 882 feet; total degrees of curvature, 6,370°; weight of rail per yard, 56½ pounds and 70 pounds; 33 way-stations, 59 engines, 48 passenger-cars, 17 baggage-cars, 1,666 freight-cars; miles run in one year, 947,382.

Graduation and masonry, per mile of main road	$22,352 50
Wooden bridges, (6,092½ feet,) per foot	$38 08

Superstructure, per mile of single track	$7,243 78
Engineering, per mile of main road	$1,105 74
Total cost of road in complete running order, per mile of main road	$64,214 56
Total cost of road in running order, exclusive of land damages and stations, per mile of main road	$60,042 52

Velocity of express trains, 35 miles; accommodation trains, 28 miles; freight trains, 15 miles per hour.

2. *Boston and Lowell railway.*

Length of road, 26 miles, all double track; branches, sidings, &c., 16⅝ miles: equivalent to 68⅝ miles single track. Maximum grade, 10 feet for 6¼ miles; total rise and fall, 190 feet; minimum radius of curvature, 1,975 feet; total degrees of curvature, 665°; weight of rail per yard, 56, 60, 63 pounds; 9 way stations, 22 engines, 22 passenger-cars, 11 baggage-cars, 308 freight-cars; miles run in one year, 275,681.

Graduation and masonary, per mile of main road	$15,475 00
Wooden bridges, (2,397 feet.) per running foot	$18 81
Superstructure, per mile of single track	$4,967 60
Engineering, per mile of main road	$1,632 35
Total cost of road, equipment, &c., in complete running order, per mile of main road	$78,636 00
Total cost of road in running order, exclusive of land damages and stations, per mile of main road	$39,090 34

On the road the land damages and cost of depots, stations, &c., were enormous. Velocity of express trains, 35 miles; accommodation, 25 miles; freight, 12 miles per hour.

3. *Boston and Maine railway.*

Length of road, 74 miles, of which 46½ double track; branches, sidings, &c., 29½ miles: equivalent to 103½ miles single track. Maximum grade, 47½ feet for three-fourths of a mile; total rise and fall, 1,498 feet; minimum radius of curvature, 1,050 feet; total degrees of curvature, 1,988°; weight of rail per yard, 56 and 60 pounds; 18 way-stations; 28 engines; 35 passenger-cars, 13 baggage-cars, 585 freight-cars; number of miles run in one year, 516,328.

Graduation and masonry per mile of main road	$11,920 00
Wooden bridges, (9,619 feet,) per foot	$38 61
Superstructure, per mile of single track	$9,517 67
Total cost, in complete running order, per mile of main road	$55,558 71
Total cost in running order, exclusive of land damages, stations, &c., per mile of main road	$38,525 78

Velocity of express trains, 36 miles per hour.
Velocity of accommodation trains, 24 miles per hour.
Velocity of freight trains, 11 miles per hour.

4. *Boston and Providence railway.*

Length, 43½ miles, of which 15¾ double track; sidings, branches, &c., 19 miles: equivalent to 78¼ miles single track. Maximum grade, 37½ feet; total rise and fall, 505 feet; minimum radius of curvature, 1,910 feet; total degrees of curvature, 342°; weight of rail yer yard, 56 to 58 pounds; 26 way-stations; 20 engines; 31 passenger-cars; 9 baggage-cars; 125 freight-cars; number of miles run in one year, 305,734.

Graduation and masonry, per mile, main road	$17,625 50
Wooden bridges, per running foot	$32 00

Iron bridges, per running foot	$40 00
Superstructure, per mile, single track	$8,390 75
Engineering, per mile, main road	$2,294 00
Total cost in complete running order, per mile, main road	$81,273 00
Total cost in running order, deducting land damages, stations, &c., per mile, main road	$57,397 00

Velocity of express trains, 34½ miles per hour.
Velocity of accommodation trains, 25 miles per hour.
Velocity of freight trains, 14 miles per hour.

5. *Vermont Central road.*

Length, 124 miles.

Graduation, per mile	$14,517 00
Masonry and bridges	$6,599 00
Superstructure, per mile	$8,594 00
Engineering	$928 00
Total cost in complete running order, per mile	$55,685 00
Total cost per mile, excluding land, stations, &c	$49,852 00

6. *New York Northern road—Ogdensburg.*

Length, 118 miles.

Grading and masonry, per mile	$15,567 00
Superstructure	$9,545 00
Bridges	$1,203 00
Engineering	$1,099 00
Total cost per mile, in complete running order	$40,005 00
Total cost per mile, exclusive of land, stations, &c	$34,810 00

Average of the six preceding roads.

Graduation and masonry, per mile	$17,343 00
Wooden bridges, per running foot	$31 90
Iron bridges, per running foot	$40 00
Superstructure, including iron, per mile, single track	$8,042 50
Engineering, per mile, main road	$1,411 60
Total cost per mile, main road, in complete running order	$62,561 00
Total cost per mile, main road, in running order, exclusive of land damages, stations, &c	$46,619 00

Average of fifteen New England roads.

Engineering, per mile of main road	$1,041 00
Total cost, per mile of main road, exclusive of land damages, stations, &c.	$36,305 00

The average of 36 Massachusetts roads gives as the velocity of passenger trains 23.8 miles per hour, and as the velocity of freight trains 13 miles per hour; and the average cost per mile of 1,415 miles of road in the same State, as $43,659 85 per mile of main roads.

DEPOTS, &C.

For a large depot of an important road an area of about 50 acres is necessary, to accommodate all the requisite shops, sheds, storehouses, &c.

For ordinary way stations, about 5 to 10 acres.

An engine-house for, say, 7 engines, costs, with turn-tables, about............	$3,500 00
A common way-station house, about..................................	$1,500 00

REPAIRS AND INSPECTION OF TRACK.

It is generally the case, on our roads, that one man carefully inspects about two miles of track every day. He makes all the small repairs that are necessary.

By the use of hand-cars, from five to ten miles of track could be daily inspected and repaired by one party.

TUNNELS.

"It is a rule which may be regarded as generally applicable, that to make a cutting more than sixty feet deep would be costlier than to 'bore,' unless the material is required for a neighboring embankment. Economy is the principal test in these matters; for in the present advanced stage of engineering, a tunnel may be made of almost any length, and through almost any substance, from granite rock to quicksand, and therefore the nature of the ground can hardly be said to oppose any other obstacle than that occasioned by the cost."

There is, however, an instance of an excavation 110 feet in depth in sand.

Shafts are usually sunk along the line of the tunnel at from 500 to 1,000 feet apart. On the Blaisy tunnel one shaft is 646 feet in depth; on the Nerthe tunnel one of 610 feet.

It is now a quite generally received opinion that shafts are not so necessary for the ventilation of the tunnel after its completion as was formerly supposed to be the case. Where it was proposed to use machinery for excavating, a tunnel of 7.5 miles miles has been projected without the use of shafts.

Shafts are usually from 7 to 11 feet in diameter.

The largest tunnel of which I can find a record is one in the district of Schemnitz, in Hungary. Its length is variously stated at from 10 to 11½ miles. It is used to drain an extensive series of mines, and also for the transportation of ore on railway cars.

The longest tunnel of large dimensions which I find recorded as having actually been completed is one in France. It is 3½ miles long, and a little more than 26 feet in diameter; 54 shafts were employed.

The section of railway tunnels varies considerably in different countries and on different roads. The dimensions of several will be found in the tables which follow.

Several machines for the excavation of tunnels have been invented. It does not appear that any of them have proved successful; so that in estimating the time necessary to construct any proposed tunnel, it will be safer to base the calculation upon the results of works actually completed.

As a general thing, headings, as they are called—small tunnels in fact—are first driven through, and afterwards enlarged, to form the large tunnel. This method of proceeding has great advantages in some localities, but is not always resorted to.

The grades can be so arranged in railway tunnels as to facilitate the drainage during the construction by establishing a summit in the middle of the tunnel, thus allowing the water to run out at each end without interfering with the work; there are instances of great embarrassment caused by the neglect of this simple precaution.

In *France* there are 56 tunnels on railways; eight canals, 36 of which have an aggregate length of 45.4 miles. The longest of small size is 7.45 miles, and that of large dimensions 3.5 miles. The Rouen and Havre road has eight tunnels; Paris and Lyons also eight.

The aqueduct from the Durance to Marseilles has three tunnels, whose aggregate length is 10.5 miles.

That through the Taillades had 7,320 gallons of water pumped out per minute during a part of the time it was under construction.

The *Nerthe* tunnel, near Marseilles, is 15,153 feet long; has twenty-four shafts, whose aggregate length is 7,589 feet—the deepest being 610 feet. It is in very hard limestone rock; is 29½ feet high by 26¼ feet wide. The shafts are lined with masonry; a portion of the body of the tunnel is lined with masonry, one, two, and three bricks thick; another portion is not lined at all. A semi-circular brick aqueduct, 4½ inches in diameter, runs the whole length of the tunnel under the floor. The time occupied in the construction is not stated.

The cost of the Nerthe tunnel was as follows:

For mining the body of the tunnel	$705,982 20
For mining the shafts	$109,081 08
Masonry for the shafts	$49,069 31
Lining for the body of the tunnel	$423,711 18
Cost of aqueduct	$10,607 10
Total cost of the tunnel	$1,298,450 87

The average cost of *excavating* the shafts, which are nine feet ten inches in clear diameter, was $43 per yard down; the average cost of the lining of the shafts was $19 40 per yard down. The deepest shaft cost, on the average, $73 per yard down, completed.

Cost of mining the body of the tunnel, $139 76½ per running yard.

On the *German* railways are ten tunnels.

The great "*gallerie d'ecoulement*" of the Clansthal mines, through the Hartz mountains, is 6.5 miles long. It was commenced in 1777 and completed in 1800, (twenty-three years,) and cost a little more than $350,000. Some authorities state this tunnel to be 7.5 miles long. Its dimensions are not given, but it is probably small.

In *Sardinia* there is a tunnel two miles long, through Mt. Giovi, on the Genoa and Turin railway. On this road, in 25 miles through the Appenines, are nine tunnels.

In *Austria* the Sommerung tunnel is one mile long.

England has 48 canal tunnels of an aggregate length of 40 miles; the largest being over three miles, on the Huddersfield canal. She has also 79 railway tunnels; 49 of which amount to 33 miles, the longest being three miles.

The London and Birmingham railway has eight tunnels; London and Dover, five; Newcastle and Dover, five.

The *Woodhead* tunnel, between Manchester and Sheffield, is a little more than three miles long. It has five shafts ten feet in diameter, which vary from 400 to 600 in depth. The character of the rock is granitic, being "mill-stone rock." The tunnel was about five years in construction, and its whole cost was $1,026,705.

Uppingham tunnel, 1,320 feet in length, cost $120 per lineal yard.

Saltwood tunnel, in very wet sand, cost $524 43 per lineal yard.

The United States has 67 tunnels on canals and railways, the longest of which is about one mile. Details are difficult to obtain. Many of them are short, however.

Baltimore and Ohio road has 16 tunnels; Parkersburg road, 17; Hempfield, seven.

The *old canal* tunnels cost, on an average, about $17 77 per running yard.

Those of *ordinary size for railways* cost from $88 per lineal yard, for those in soft sandstone not requiring a lining of masonry, to $444 and $710 per yard, in very loose ground, such as quicksand, &c., requiring a very tick lining.

Ordinary brick lining costs from $8 to $9 per cubic yard, including centering.

The *shafts* for the Blechingly tunnel, 10.5 feet in diameter, sunk in blue clay, and lined, cost $68 44 per yard down. The longest shaft is 97 feet.

Those of the Blaisy tunnel cost, lined, $139 11 per yard down. The soil was of clay, chalk, and loose earth. Deepest shaft 646 feet, and few less than 328 feet.

The cost of shafts varies in proportion to their depth, &c., &c.

The cost of those in the Black Rock tunnel, Pennsylvania, in hard slate, was $79 50 per yard down, or $18 72 per cubic yard. The shafts were seven feet in diameter, and 139 feet deep.

The cost per cubic yard of excavating tunnels has been in the—

Black Rock, hard greywacke slate, (U. S.)	$6.60
Lehigh, very hard granite, (U. S.)	$4.36
Schuylkill, slate, (U. S.)	$2.00
Union, slate, (U. S.)	$2.085
Blisworth, blue clay, lined, (Eng.)	$1.545
Box, freestone, marble, clay, &c., lined, (Eng.)	$3.464
Blaisy, exclusive of shafts, but including the lining, (France)	$3.176
Blue Ridge, cost per cubic yard	$4.000

The Blaisy tunnel cost, exclusive of shafts, $108 31 per lineal foot.

In comparing the cost of tunnels in different countries, the difference of the price of labor should be considered. This has not been done in any of the examples here given; the actual cost in pounds sterling, &c., being simply reduced to dollars.

The time required to drive the *heading* of the Black Rock tunnel was 1,243 days and 1,144 nights, or 2,387 spaces of 12 hours each, for 1,782.5 feet in length of tunnel.

For details of this tunnel, see the following tables.

In the Kilsby tunnel, a working shaft 129 feet deep, much troubled with water, was finished in seven or eight weeks.

In hard rock, where continual blasting is required, two expert miners can run a "branch" 40 inches by 32 inches to the length of 10.5 inches in 12 hours.

A tunnel cannot be pushed further than 500 feet without resorting to artificial means of ventilation.

Ventilation is found to be better in cold weather than in warm.

Headings are about 12 feet high; width at base, that of tunnel at that height.

In the table on the succeeding page,

P. L. means partly lined with masonry.
L. " lined with masonry.
N. L. " not lined with masonry.
Z. " not stated.
S. " has shafts.
S. S. " supposed to have shafts.
C. " average depth.
a. " average per running foot taken from total cost.
D. " was constructed to drain the lakes in the valley of Mexico, to prevent overflows.

Measures are in feet and decimals;
Time, in working days;
Cost, in dollars and decimals.

(X.)—For details of construction of Kilsby tunnel, see American Railroad Journal, vol. I, new series, (1838,) page 229 *et seq.*

Comparative Table of some of the largest Tunnels.

Name of tunnel.		Date.	Formation.	Shafts.	Maximum depth.	Section of tunnel.	Length, in feet.	Time required, in days.	Cost per lineal foot.	Total cost.	Locality.
					Feet.				*Dollars.*	*Dollars.*	
Narthe	P. L.	Z	Hard limestone	24	610	20.5 × 26.25	15,153	....	....	1,298,450	Near Marseilles, France.
Riqueval	P. L.	1803	Chalk	54	210	26.25 × 26.26	18,623	2,139	39.887	742,817	St. Quentin canal, France.
Pouilly	P. L.	1824	Chalk and clay	33	164	20.34 × 20.34	10,928	2,504	113.965	1,245,412	Bourgogne canal, France.
Aschviller	Z	1839	Z	S. S.	Z	26.25 × 26.25	7,384	1,878	68.38	a. 504,897	Maine and Rhine canal, France.
Mauvage	Z	1840	Z	S	Z	25.50 × 25.59	15,752	2,085	94.43	a. 1,487,383	Maine and Rhine canal, France.
Rolleboise	Z	1841	Chalk	S. S.	Z	24.94 × 24.94	8,670	636	62.98	546,000	Rouen railway, France.
Roule	Z	1841	Z	S. S.	Z	24.94 × 24.94	5,645	522	62.98	355,513	Rouen railway, France.
Lioran	Z	1839	Z	S. S.	Z	21.33 × 21.33	4,548	2,087	56.98	259,178	National road, No. 126, France.
Kilsby, (X)	L	1834	Clay and sand	18	164	27 × 23.50	7,233	1,232	194.31	1,405,417	London and Birmingham railway, England.
Bletchingly	L	1840	Blue clay	12	97	24 × 25.05	3,972	626	102.86	423,271	London and Dover railway, England.
Thames and Medway	P. L.	1822	Chalk	S	194	30 × 38.7	11,880	930	45.50	541,550	Thames and Medway canal, England.
Box	P. L.	1837	Marble, freestone, marl, &c.	15	400	35 × 39	9,680	1,232	148.15	1,434,063	Great Western railway—shafts 25 feet diameter, one-third of tunnel in rock—England.
Hare Castle	L	1824	Rock and sand	15	167	14 × 16	8,778	930	57.05	500,799	Trent and Mersey canal, England.
Nochistongo (D)	L	1807	Clay and marl	8	164	13.78 × 11.48	21,659	967	....	....	Lake Zumpango, Mexico; a Desagua.
Blisworth	L	1796	Rock and clay	19	59	16.5 × 18	9,940	2,191	23.185	214,929	G. J. canal, England.
Sapperton	P. L.	1789	Rock	S. S.	246	15 × 15	12,900	1,878	12.44	160,476	Thames and Severn canal, England.
Black Rock	NL	1835	Greywacke slate	6	139	19 × 17.93	1,932	....	77.18	149,130	Reading, Penn., railway, United States.
Blaisy	L	1846	Chalk, clay, &c.	22	646	26.25 × 26.25	13,455	1,043	136.06	1,830,730	Paris and Lyons railway, France.
Edge Hill	P. L.	1826	Clay and freestone	8	Z	22 × 16	6,600	....	30.15	198,969	Liverpool and Manchester railway, England.
Littlebourg	L	1840	Z	14	(c)177	27.5 × 24	8,607	590	129.61	1,115,544	Manchester and Leeds railway, England.
Woodhead	Z	Z	Millstone rock	5	600	....	15,840	1,800	....	1,026,705	Manchester and Sheffield railway, England.

A tunnel has been projected at Mt. Cenis, on the line of the Lyons and Turin railway, of the length of 7.6 miles; the gradient in the tunnel to be 105 feet to the mile; the section of the tunnel to be 19 by 25 feet; *no shafts to be used.* By the aid of machinery it was expected to complete this work in five years, at an expense of $2,615,000.

The inventor of the machine and the engineer of the road is the Chevalier Mause. His plans and estimates were submitted to, and approved by, a board of eminent engineers and geologists, among whom was the celebrated Mr. Robert Stevenson.

The tunnel projected through the *Hoosack* mountain was to have been 4½ miles long, 23 feet by 22 feet; two shafts about 850 feet and 750 feet deep, 10 feet in diameter. The cost variously estimated at from $2,000,000 to $3,000,000. Time estimated by different engineers at from four to ten years. The machinery designed for boring did not succeed, and the project has not as yet been commenced seriously.

At the crossing of the Blue Ridge by the Virginia Central railroad there are four tunnels. The main tunnel is 4,280 feet in length; has been four years under construction, and is estimated to require two years more to complete it. No shafts are used. It is ventilated by machinery. A portion of it is lined. It is for a single track, and is in the clear 21 feet high by 15 feet in width. Where lined, the abutments of the lining are 4 feet thick; the arches 3 feet thick. The excavation in these places is 26 feet high by 23 feet wide.

A portion of one of the small tunnels is through a very difficult formation of loose rock and earth. In the main tunnel much trouble is experienced from the water.

The main tunnel is 700 feet below the crest of the mountain through which it passes. The workmen are arranged in three reliefs, and work night and day. No machinery is used for boring or excavating. It is the opinion of the engineer that no machinery can be applied when the tunnel requires lining, for want of space. He states that no excavating machine has yet been successful.

SNOW.

The roads in Massachusetts, with rare exceptions, find little difficulty in clearing the track from snow in the course of one day. They only fail to do so when the snow drifts badly, and packs hard.

To open the road, from two to five engines are attached to each train, with a snow-plough in front. The train pushes through until stopped, when it backs off and again advances.

Snow to the depth of five or six feet, as a maximum, can be cleared in this manner. With higher ploughs and additional power, it is possible that slightly greater depths of light snow may be worked through.

Snow a foot deep does not present a very great obstacle—that is to say, the train makes regular progress at reduced speed.

Embankments are far less obstructed than cuts.

Cuts of twenty feet deep, and upwards, are less obstructed than those of from five to ten feet.

Alongside of cuts like the latter, *snow fences* are used. These are board fences, about eight feet high, placed some twelve feet back from the edge of the excavation.

Drifting snow obstructs a train far more than a settled fall; for when the engine is brought to a state of rest, and finds it necessary to "back" in order to obtain a new impetus, the snow blows in under the wheels, and sometimes "blocks" the train so that it cannot move either way. In such cases a large manual force is necessary to clear all the wheels at once.

Men and shovels are always carried on the train when the fall of snow is great, in order partially to open heavy drifts and to provide for the contingency of the train being blocked.

Freight trains should be discontinued until the road is opened; the work being done by the passenger trains.

Light dry snow is by no means so serious an obstacle as wet heavy snow, except in regard to its liability to drift.

In opening the road over heavy gradients, commence working from the summit.

When the snow opposes a considerable resistance the engines use about double the usual quantity of fuel and water.

Snow-ploughs are generally of two sizes; the larger sizes are from nine to ten feet high, and about seven feet broad; the smaller are about four feet high by seven feet broad, and are sometimes of iron.

FREIGHTS.

Average freights during the last eight years from Calcutta to Boston $15 per ton.

Average for same time from Calcutta to London $17 per ton.

From Canton to the United States $10 to $18 per ton.

From Canton to England $26 per ton.

From Shanghai to the United States $10 to $20 per ton.

From Shanghai to England $26 to $30 per ton.

Freights from Boston to San Francisco average since 1849, $22 per ton; at present, $12 per ton.

Average freight from China and the East Indies to San Francisco $13 per ton.

Silks usually pay $5 per ton more than teas.

CATTLE, &C.

The total number of live stock carried over the Baltimore and Ohio railway during the year ending September 30, 1854, was 164,869, of which number 75,575 were transported a distance of 368 miles.

At the *same rate of freight* as on the Baltimore and Ohio road it would cost about $36 per head for horned cattle from Fort Smith to San Francisco, and about $42 per head from Memphis.

To transport horses and mules by railroad from Memphis to San Francisco, by way of Fort Smith, would cost about $47 per head.

REPORT

UPON

THE COST OF TRANSPORTING TROOPS AND SUPPLIES

TO

CALIFORNIA, OREGON, NEW MEXICO,

ETC., ETC.

BY

MAJOR GENERAL THOMAS S. JESUP,

QUARTERMASTER GENERAL, U. S. ARMY.

COST OF TRANSPORTING TROOPS, &c.

Quartermaster General's Office,
Washington City, November 16, 1854.

Sir: In reply to your letter, dated the 8th instant, asking information in regard to transportation, I have the honor to report, in answer to the "1st.—The present cost of transporting troops to San Francisco and Fort Vancouver, via the Isthmus, how much for each officer and soldier; stating whether the price includes their food, and, if not, what additional amount is paid for food, or the transportation of their rations and arms,"—that the last troops sent to San Francisco, via the Isthmus, (in May, 1854,) their transportation was as follows: $225 for each commissioned officer; $150 for each enlisted soldier, laundress, &c.

The whole were subsisted by the contractor; 100 pounds of baggage allowed to each person on the steamers, and 25 pounds each across the Isthmus; *all over* the 25 pounds across the Isthmus to be paid for at 15 cents per pound. No troops have been sent from the Atlantic coast direct to Vancouver or Oregon, via the Isthmus. For those sent from San Francisco, California, to Vancouver or Oregon, in June, 1853, $75 was paid for each commissioned officer, and $40 for each enlisted soldier, &c., and $30 a ton for stores. In December, 1853, $15 a ton, and in February, 1854, $20 a ton, for stores.

From information received from New York since the receipt of your letter, I learn that the company now demands $300 for each officer, and $150 for each enlisted soldier, from New Orleans to San Francisco, including the transit of the Isthmus—extra baggage to be paid for at 15 cents per ponnd.

To the "2d.—What is the cost of the transportation of provisions, in bulk, to San Francisco and Fort Vancouver, via the Isthmus, and also via Cape Horn,"—I have to report that no provisions or other public stores, in bulk, have been sent to San Francisco or Fort Vancouver, via the Isthmus; but from information just received from New York, I learn that the present charges by that route are $14 a ton to Aspinwall, $300 a ton (15 cents per pound) across the Isthmus, and $80 a ton from Panama to San Francisco—say $394 a ton of 2,000 pounds. The agents of the line *think*, that when the railroad across the Isthmus shall be completed, the freight across will not exceed one-fourth of the above, $75 a ton—say $169 for the whole distance. Via Cape Horn to San Francisco, or Benicia, subsistence stores have been shipped during the present year from Baltimore at 90 cents per cubic foot, $4 50 per flour-barrel; and from New York at $3 70 per barrel for flour, and 60 cents per cubic foot for other packages.

To the "3d."—The same rates will apply to camp and garrison equipage and clothing; as all such freight, by sea-going vessels, is charged for by the cubic foot.

To the "4th," I have to report that ordnance and ordnance stores have been sent from New York, via Cape Horn, in June, 1854, at two cents per pound for ordnance, consisting of heavy guns, carriages, shot and shells; in August at $28 per ton for the same, and in October at two cents a pound for the heavy ordnance; and 60 cents per cubic foot for ammunition, and other boxes, &c. None have been sent via the Isthmus.

To the "5th" I report, that, during the present year, the contracts for the transportation of military stores of *all* kinds are as follows:

From Fort Leavenworth to El Paso, $14 per 100 lbs.

From Fort Leavenworth to Fort Fillmore, $13 75 per 100 lbs.

From Fort Leavenworth to Albuquerque, $10 83 per 100 lbs.

From Fort Leavenworth to Fort Union, $7 96 per 100 lbs.

No transportation has ever been paid for men, as they march, the only cost being for the transportation of their baggage, subsistence, &c., on the route. This may be estimated at about $15 per man to Albuquerque. The above are about the average rates for several years past, and it may be presumed will be those for the future.

As to what was the cost of transporting artillery and supplies from the city of New York to the northern frontier in the war of 1812–'14, this office furnishes no information, and I think it would be extremely difficult, if not impossible, to ascertain what were the average rates. There were no permanent or Macadamized roads in northern New York during that period, and the passage of heavy-loaded wagons, at the best of times, extremely difficult and slow. It may be fair to presume that each ton cost at the rate of $5 (the daily cost of a wagon and team) for each ten miles of distance from Albany to the different points on the frontier when the roads were in the best condition, and double this in the spring and fall of the year—say from fifty cents to one dollar a mile for each ton transported.

For General Harrison's army on the northwestern frontier, there were instances when the teams, loaded with forage, not only consumed all they were transporting to that army, but had to draw forage from the army depots to enable them to return. Much of the subsistence intended for the army was also consumed by the teamsters and escorts en route.

Since writing the above, I have information from New York that heavy freight can now be sent to San Francisco at about $15 a ton, and 30 cents per foot for measurement goods, and that a vessel could be chartered for Fort Vancouver at $20 a ton. These rates should not, however, be taken as ruling for the coming year, freight of all kinds being extremely low at this time.

I have the honor to be your obedient servant,

TH. S. JESUP,
Quartermaster General.

Hon. JEFFN. DAVIS,
Secretary of War.

EXPLORATIONS AND SURVEYS FOR A RAILROAD ROUTE FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

WAR DEPARTMENT.

REPORT

OF

EXPLORATIONS FOR A ROUTE FOR THE PACIFIC RAILROAD,

NEAR THE

FORTY-SEVENTH AND FORTY-NINTH PARALLELS OF NORTH LATITUDE,

FROM

ST. PAUL TO PUGET SOUND.

BY

I. I. STEVENS,

GOVERNOR OF WASHINGTON TERRITORY.

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PART I.

REPORTS FROM THE FIELD.

Upper Mississippi,
Steamer Nominee, May 27, 1853.

Dear Sir: I have the honor respectfully to inform the department, that I left Washington city on the 9th instant, stopped in New York one day to transact business, and taking the route of Lake Erie and Chicago, reached St. Louis on the 15th. I remained in St. Louis until the departure of the Fur Company's boat on the 21st, which carried up ten thousand rations to Fort Union, and a small party, consisting of Lieutenant Donelson, Lieutenant Mullan, Mr. Graham, and six sappers and miners. Lieutenant Donelson is instructed to make the best possible survey of the Missouri, and of the country in the vicinity of Fort Union, from the White Earth to the Porcupine rivers. Whilst at St. Louis I secured the services of Alexander Culbertson, Esq., as a special agent among the Blackfeet Indians. He has lived in the country twenty years, and knows by name every adult male in each tribe. He estimates the number to be from fifteen hundred to eighteen hundred lodges. I found him to be a reliable, steadfast, calm man. He joins the main party at Fort Union, and accompanies us to Fort Benton. The Fur Company make the trip, 400 miles, in twenty days, four mules drawing 1,600 pounds. The grasses in the Blackfeet region are exceedingly good, the country is well watered, and wagons can be taken to the very base of the mountains.

The Blackfeet tribes know all the passes in the mountains, and Mr. Culbertson assures me that we shall have no difficulty in securing the confidence of, and controlling the Blackfeet. With vigilance and firmness, I entertain no apprehensions whatever.

Dr. John Evans, who is intrusted with the geological reconnaissance of Oregon, under the supervision of the General Land Office, for which Congress has made a special appropriation, has accepted the position of geologist of my expedition. He will, on his way to Oregon, go through the "Mauvaises Terres," exploring the routes in that interesting region, connecting it with the Missouri by two lines, leading respectively to Fort Pierre and Fort Union, and making for my exploration collections of the highest value to geological science. The topographical information which he will collect will be a great assistance in enabling me to determine the best route for my return party. Dr. Evans will place at the disposal of the expedition all his topographical notes and barometrical observations crossing the mountains, and thus, at very small expense, the expedition will derive from his labors great aid in both its direct and incidental objects.

I shall reach St. Paul's this evening, where I expect to find all the arrangements well advanced to commence the exploration, and from which place I hope to start, at the furthest, by the first of June. I will communicate again with the department as I leave the settlements, and will at the same time enclose a statement of expenditures up to that point.

I enclose, herewith, printed copies of the instructions given in each branch of the survey. As the party was quite numerous, and each member receives copies of them, in addition to specific instructions, I had them all printed, except the paper called "General Organization of the Expedition," as it was more economical than to be subjected to clerk hire for so great a labor.

I have the honor to be, very truly, your obedient servant,

ISAAC I. STEVENS.

Hon. Jefferson Davis,
Secretary of War.

NORTHERN PACIFIC RAILROAD EXPEDITION.

The special object of the exploration is the determination of a railroad route from the head-waters of the Mississippi river to Puget sound. In consequence of the meagreness of the information in reference to the country to be gone over, particularly in the Rocky and Cascade mountains, a general topographical survey must be had of these mountains between the 46th and 49th parallels, and of most of the intervening country, in order to determine the general course of the railroad and furnish the data to guide the civil engineers in determining the route. The operations involved are therefore as follows:

1. *A general reconnaissance of the country.*—This reconnaissance will embrace the general features of the country, as mountain ranges and passes, windings of rivers and streams, their dividing ridges, prairies, and everything which shall be necessary in the construction of a general map of the country passed over. The result of this examination, done by reconnoitring corps assigned to the special duty, will be to determine the most advantageous route to be pursued for the railroad, and to direct the movements of the party intrusted with locating it. It will be an important object in the general reconnaissance to determine, with all possible accuracy, the important features of the country, especially those which have a bearing upon the location and construction of the proposed railroad. Of this class are the important points of the Missouri and Columbia rivers, as the heads of steamboat and boat navigation; the debouches of the mountain passes, both of the Cascade and Rocky mountain ranges; and of such important points the latitude and longitude should be determined, either by the sextant and transit, or by the sextant and chronometer, as may be practicable. The observations of important objects by compass ranges should be referred either to those points whose geographical positions have been determined, or to the base line of the route.

Parties intrusted with reconnaissances and surveys will make topographical sketches of the country on the several routes pursued by them, and will, as far as practicable, be supplied with the necessary instruments for working with facility. In the lack of an odometer for measurement, such means must be made use of as are generally resorted to in similar cases, as measurement by the pace of a horse or a man, &c.

2. *The survey and location of the railroad.*—This will be along the route resulting from the labors of the reconnoitring corps, and will embrace all the facts bearing upon the construction of the road; particular regard being had by the reconnoitring corps, and the corps intrusted with the location of the road, to the natural facilities for the transportation of iron, supplies, &c., which will be required for the road. Objects observed will be referred to the known points of the base line of the route, referred to hereafter. The route will be run by compass courses day by day, and measured by an odometer, and the results thus obtained, checked by the daily determination of latitude and longitude, will form the base line, to which will be referred all objects observed in the survey.

A general profile of the route will be determined by means of barometrical measurements. The altitudes of the halting places at night and noon, the tops of ridges and bottoms of valleys, and, so far as possible, the altitudes for the construction of a continuous profile, in connexion with the measurements by the odometer, will be obtained. In the crossing of rivers, the height of the banks must be noted; the depth of the water, the apparent highest water, the nature of the bottom on which the foundation for the abutments and piers must rest, the width between the banks, and all information determining the means and cost for carrying a road over the stream, should be obtained as fully as practicable. So, in smaller crossings of gullies and small streams, similar facts in reference to culverts should be obtained. In general, everything in the character of the country passed over affecting the construction of a railroad will be noted, the estimated or determined grades, the nature of the excavation, facilities for obtaining stone, timber, and all building materials, &c., &c.

The positions of all objects noted on the route will be determined either directly by the odometer and compass, referred to the line of the route by compass bearing and estimated distance from one point, or simply sketched in, according to the importance of the object.

3. The decisive points which must determine the location of the road are the mountain passes of the Cascade and Rocky mountain ranges; and it may occur that the location of the road between the two ranges, and for a long distance east of the Rocky mountains, must be suspended until these passes be examined and selected; and much of the general reconnaissance must be made after the selection of these mountain passes, which are the controlling points of the survey.

It is proposed to construct the following maps, embodying the geographical results of the exploration; and the efforts of reconnoitring and surveying parties will be especially directed to obtaining the best data for the construction of these maps:

A general map, scale $\frac{1}{2000000}$, from the headwaters of the Mississippi river to the Pacific ocean, and from the 42d to the 56th parallel.

A map in two sheets, scale $\frac{1}{1200000}$, of Washington Territory, and thence eastward to the headwaters of the Mississippi.

A map, scale $\frac{1}{400000}$, Cascade range, Rocky mountains, and other critical points of the route.

Mountain passes, scale $\frac{1}{80000}$.

Working sketches, scale $\frac{1}{40000}$.

The field-books are constructed so as to be convenient for reduction to the scale of the several maps above. As ruled, in small squares of about $\frac{3}{8}$ inch side, each side represents $\frac{1}{4}$ of a statute mile, scale $\frac{1}{40000}$, and it is designed that this scale should be generally used in sketching. Where necessary, however, to depart from it, the sketches should be of a scale $\frac{1}{5000}$, $\frac{1}{10000}$, $\frac{1}{80000}$, &c., the sides of the squares respectively representing $\frac{1}{32}$, $\frac{1}{16}$, $\frac{1}{2}$, statute mile, as shall be found necessary, the scale by which the sketch is made being marked on the page containing it. The direction of the magnetic meridian of the sketch (running longitudinally down the page, or taking the direction of the other sides of the square, as shall be most convenient at different times) will also be noted on each page, and the magnetic variations recorded in the field-book with each day's work.

The work of the day will be made up in camp at night with ink, and will be transferred by the draughtsman to the general map, scale $\frac{1}{1200000}$.

GENERAL ORGANIZATION OF THE EXPEDITION.

1. The expedition is in charge of Isaac I. Stevens, governor of the Territory of Washington.

2. There will be two main parties in prosecuting the work. One party, under the immediate direction of Governor Stevens, will proceed from the Mississippi river, and surveying rapidly the intermediate country, will reach as early as practicable the Rocky mountains, and examine all the passes to ascertain the most practicable one. The second party, under the command of Brevet Captain George B. McClellan, will organize at Puget sound, or on the Columbia, and operate for a similar purpose in the Cascade range of mountains. The parties will operate in

the mountains until they are thoroughly explored, or till driven away by the snow, when they will be applied, with probably a somewhat reduced organization, to the survey of the intermediate region.

To insure unity in the entire operation, Governor Stevens, as soon as the eastern party has been put to work on the Rocky mountains, will advance rapidly with a small reconnoitring force to meet Captain McClellan and arrange the entire operations.

For more full information as to the organization of the expedition and character of the survey, see the printed instructions of the Secretary of War.

3. All officers detailed on the survey are on topographical duty, and will in the field receive one dollar per day.

4. Lieutenant Rufus Saxton, jr., is the acting assistant quartermaster and commissary of the expedition. His most important duty as such is, as early as practicable to cross the isthmus, and establish a depot of provisions at the Flathead village of St. Mary's, just west of the Rocky mountains, and then crossing the mountains by the Blackfoot trail, meet the eastern party at Fort Benton, at the sources of the Missouri river.

5. Till he joins the main party, Lieutenant Cuvier Grover will act as commissary and quartermaster for the eastern party.

6. Under the instructions of the Secretary of War, the administrative branches of the service will bear all the expenses of the army portion of the expedition. The appropriation for the survey will be chargeable with the pay, subsistence and transportation of the civilians employed as a scientific corps, and their assistants, with instruments and collections.

7. Each officer and scientific man of the expedition will keep a daily journal, noting everything worthy of observation of a general character. These journals will be deemed a part of the results of the expedition, will be turned over as a part of its archives, and will be made use of in preparing the report. This is not intended to preclude copies being taken and published by the writer, after the publication of the report and proceedings of the expedition.

8. Whilst every effort will be made to render the expedition in all its parts effective, the most rigid economy is enjoined. Transportation is not only expensive but cumbersome. Personal baggage must be reduced to the smallest practicable amount. Attendants and animals to be kept at a minimum. Great care must be taken in matters of account, particularly in the division of the expenses between the survey and administrative branches of the services.

9. The clerk and disbursing agent is Isaac F. Osgood. He will keep an account of books and instruments, taking receipts therefor whenever practicable. They will be turned over to him when not wanted for further use.

10. Professor Spencer F. Baird is the naturalist of the expedition. The naturalists and collectors, for full information in reference to their duties, are referred to his printed notes prepared expressly for this expedition, and his printed directions prepared for the Smithsonian Institution. The collections will all be sent to him in Washington for the preparation of that portion of the report.

11. Dr. John Evans is the geologist of the expedition; and the geologists and collectors are referred to his printed paper for valuable suggestions in reference to that interesting and almost unexplored region in which the expedition will operate.

12. For instructions in reference to meteorological matters, see printed instructions.

13. For full information and instructions in reference to the topographical and railway survey, reference will be had to the printed instructions.

14. For magnetic and astronomical instructions, reference will be had to the written paper of the instructions.

15. Mr. Stanley is appointed the artist of the expedition. For valuable suggestions in connexion with this and other branches of the work, see a written paper prepared by him, which will serve as a basis of instructions.

16. Whilst great care will be taken to assign each man to his special and appropriate duty,

all are desired to inform themselves in reference to the general objects and results of the expedition, and do all they can to forward the several special operations.

This is the more important, as parties will be frequently subdivided, and several duties thus be, of necessity, thrown upon the same individual.

ST. LOUIS, *May* 21, 1853.

MY DEAR SIR: If it would be a possible thing for you to prepare a brief popular notice of the "Mauvaises Terres" to go into my preliminary report, I shall be glad. That report I mean to send from Puget sound, about the 15th of December, and your notes I should want a month earlier.

I hope the artist will prove equal to his duties, and that with his assistance you will be able not only to make sketches of the bad lands, but a tolerable survey, which can be incorporated into our general map. You will easily connect it with the Missouri river by your two lines to Fort Pierre and Fort Union.

At Fort Union, should I leave before your arrival, I will leave word as to the two routes I shall take, with the probable time of being at Fort Benton.

I hope I shall not fail to meet you before you cross the mountains.

Truly yours,

ISAAC I. STEVENS.

Cannot you, in the form of a journal, have a notice which will answer as a preliminary notice. And I would suggest that if, at Fort Benton, you could let me have your journal, with all your sketches and topography, the artist and draughtsman of the expedition could at once prepare them, with other matter, for publication.

Mr. JOHN EVANS, *Geologist, St. Louis.*

METEOROLOGICAL OBSERVATIONS.

PROGRAMME.

1. Permanent posts for one year, to be kept up for a longer period if additional appropriations are made.

2. Parties in the field to be continued six months; the permanent posts a result of their labor.

3. At permanent posts will be barometrical and hygrometrical observations; also, quantities of rain and snow will be carefully observed; also, observations as to wind and storms.

4. Parties in the field will all observe for temperature, wind, and storms. Some four main parties will use the barometer, and, if practicable, make observations as to rain and moisture. Aneroids to be used for detailed work.

NOTE.—The aurora borealis, temperature of hot springs, &c., will be carefully observed, both at posts and by field parties.

5. *Permanent posts.*—Four main posts: 1, Puget sound; 2, Columbia barracks; 3, the Flathead village of St. Mary's; 4, Fort Benton; and three posts of second order: 5, Fort Colville or Okinakane; 6, Fort Wallah-wallah; 7, the British trading post at the debouche of the Marias Pass; and five winter posts: 8, in the Blackfoot trail; 9, in the Marias Pass; 10, in the intermediate pass; 11, 12, two passes in the Cascade range.

NOTE.—The above programme of posts is designed to indicate what it is desirable to accomplish. Circumstances may require changes in it and a reduction of the scale.

INSTRUCTIONS FOR METEOROLOGICAL OBSERVATIONS.

NOTE.—These instructions have been drawn up by Lorin Blodget, Esq., under the direction of the Smithsonian Institution.

brought along. Sketches of geological formations, rock exposures, &c., may frequently be made to great advantage.

When possible, the subject of the sketch should always be brought along, and a corresponding number made to indicate the relation of the two.

2. Sketches of Indians should be made and colored from life, with care to fidelity in complexion as well as feature.

In their games and ceremonies, it is only necessary to give their characteristic attitudes, with drawings of the implements and weapons used, and notes in detail of each ceremony represented. It is desirable that drawings of their lodges, with their historical devices, carving, &c., be made with care.

INSTRUCTIONS FOR MAGNETIC OBSERVATIONS.

BY J. E. HILGARD, ASSISTANT U. S. COAST SURVEY.

A.—*Observations with azimuth compass.*

These observations will be made by reading the magnetic azimuth of the sun, near rising or setting, and noting the time. An observation should be taken on each limb of the sun, and the mean used. The error of the chronometer must be known by a suitable observation for time. The sun's true azimuth and resulting magnetic declination will be computed according to the printed form.

B.—*Observations with the magnetometer and dip circle.*

1. Observations of dip, declination, and relative horizontal intensity will be made daily, if practicable.

2. One set of observations of dip, without reversal of poles, will be made with each needle whenever time permits, and will be recorded in the printed form. At convenient stations, at intervals of four or five weeks, the connection depending on the reversal of poles will be determined by four sets of observations with reversal, with each needle. The dip circle may be placed in the magnetic meridian by means of the magnetic bearing of some object, determined by the azimuth compass.

3. Observations of declinations will be made and computed according to the form prepared for that purpose. The zero of the collimator magnet will be determined once a week by inversals. The observation of true azimuth may be made on the sun, or any star near rising or setting.

4. The observations of relative horizontal intensity will be made by vibrating one or both of the larger magnets in the vibration apparatus, and observing the time of 200 vibrations.

The largest arc of vibration should not exceed 2°; observations of deflection, for attaining the magnetic moment of the vibrating magnets, will be made once a month, in connexion with the observations of vibration by deflecting one of the shorter magnets with the magnets used in vibrating; the observations being made and recorded strictly according to the printed form. These sets of deflections should be observed with each magnet, at distances no less than 1.5 feet from the deflected magnet.

5. The observations of horizontal intensity cannot be reduced to absolute measure, until the moments of inertia of the vibrating magnets, (with their stirrups and suspension,) designated by K in the formula, are determined. This is done by vibrating them loaded with a ring, the moment of inertia of which K is known by its dimension and weight. Both inertia rings should be used for this purpose, and at least five series of vibrations, with and without rings, should be observed with each magnet.

These observations, as well as those for the temperature, co-efficient q, may be made during the ensuing winter. They may be made in a room, and are not influenced by local attraction.

6. Great care will be observed to place the magnets in their proper positions in the cases, and not to touch them with iron or steel. The observations must be made at a distance of at least 300 paces from the wagons, to avoid the influence of the iron tires. Observers will carefully divest their clothing of all substances having magnetic attraction.

MEMORANDA IN REFERENCE TO THE NATURAL HISTORY OPERATIONS.

PREPARED BY S. F. BAIRD, UNDER THE DIRECTION OF THE SMITHSONIAN INSTITUTION.

The general principles to be observed in making collections of natural history in a new country, or one previously unexplored, is to collect everything which may present itself, from time to time, subject to the convenience or practicability of transportation. The number of specimens to be secured will, of course, depend upon the dimensions, and the variety of form or condition caused by the different features of age, sex, or season.

Where a small part only of the specimens collected can be taken along, such species should be selected as are least likely to be procured in other localities or at other opportunities. Among these may be mentioned the reptiles, fishes, soft insects, &c.; in fact, all such as require alcohol for their preservation. Dried specimens, as skins, can be procured with less difficulty, and are likely to be brought in by persons not specially interested in scientific pursuits.

The description of various processes, to be employed in the collection and preservation of specimens of different kinds, will be found detailed at sufficient length in the "Directions" published by the Smithsonian Institution, and in the Admiralty Manual of Scientific Enquiry.

In collecting specimens of any kind, it will be important to fix, with the utmost precision, the localities where found. This is especially desirable in reference to the fishes, which occupy a very intimate relation to the waters in which they live.

The smaller quadrupeds, of the size of a mouse, may be preserved entire in alcohol. Larger kinds should be skinned, and the skins thrown into alcohol, or coated inside with arsenic and dried. The latter course may be indicated for species larger than a prairie dog or hare. The skulls of the small kinds may be left in the skins; those of the larger should be removed, taking care to attach some common mark by which they may be again brought together. Large animals, of the size of a wolf and above, may, for greater convenience, be skinned after the method pursued by butchers, by skinning the legs down to the toes, and cutting off at that point. The skins need not be sewed up, as is directed for the smaller kinds, but rolled up into bales, after applying an abundance of arsenic and drying.

It will be very important to procure the skeletons, and, at all events, the skulls, of all the species of animals, in sufficient numbers to include all the variations of age and sex. These may be roughly prepared by cutting off the flesh and drying in the sun.

As the expedition will pass through the breeding-ground of many species of birds whose nidification and eggs are not known, attention should be paid to securing abundant specimens of the nests and eggs. As far as possible the skin of the bird to which each set of eggs may belong should be secured, and have a mark attached common to it and the egg.

The larger snakes should be skinned, as indicated in the "Directions," as thereby they will occupy much less space than otherwise. The smaller specimens preserve entire, together with the lizards, salamanders, and small frogs. All of these that can be caught should be secured and preserved.

The head, legs, with feet, the tail, in fact the entire skin of turtles, may be preserved in alcohol; the soft parts then extracted from the shell, which is then to be washed and dried.

Every stream, and, indeed, many localities in each stream, when passable, should be explored for fishes, which are to be preserved as directed in the pamphlet. For these, as well as the other alcoholic collections, the lino bags will be indispensable.

All the alcohol used should be supplied with tartar emetic. This, besides adding to its preservative powers, will remove any temptation to drinking it on the part of unscrupulous persons.

Insects can, with the exception of lepideptera, be readily preserved in alcohol; crabs and small shells may likewise be treated in the same manner.

The specimens from each locality should be kept entirely separate. This can readily be done by means of the lino bags. The locality of the specimens may be marked with a red or black pencil on the outside, or written with ink on a piece of parchment and dropped inside. The ink should be perfectly dry before being wetted. Larger specimens may have the parchment label tied to some part without enclosure in the bags.

As the instructions contained in the "Directions" are not sufficiently minute in regard to plants, it will be necessary to go here into some detail. The portfolios provided are intended to receive the plants as collected. About forty or fifty sheets of the paper should be put into the portfolio on starting out on an excursion. Put the specimens of each species in a separate sheet as fast as gathered from the plant, taking a fresh sheet for each additional species. On returning to camp, place these sheets (without changing or distributing the plants) between the brown drying-papers in the press, and draw the straps tight enough to produce the requisite pressure. The next day the driers may be changed, and those previously used laid in the sun to dry. This to be continued until the plants are perfectly dry.

If paper and transportation be limited, several specimens from the same locality may be combined in the same sheet after they are dry.

Throw into each sheet a slip of paper having a number or locality written on it corresponding with a list kept in a memorandum book. Record the day of the month, locality, size, and character of the plant, color of flower, fruit, &c.

If the stem is too long, double it or cut it into lengths. Collect, if possible, half a dozen specimens of each kind. In the small specimens, collect the entire plant so as to show the root.

It will not be possible to collect minerals, fossils, and geological specimens in very great quantity of large dimensions. The fossils selected should be as perfect as possible, and especial care should be paid to procuring the bones and teeth of vertebrate animals. Of the minerals and rocks, specimens as large as a hickory-nut will, in most cases, be sufficient for identification.

All facts relating to the habits and peculiarities of the various species of animals should be carefully recorded in the note-book, especially those having relation to the peculiarities of the season of reproduction, &c. The accounts of hunters and others should also be collected, as much valuable information may thus be secured.

The colors of the reptiles and fishes when alive should always be given.

MEMORANDUM OF APPARATUS FOR MAKING COLLECTIONS IN NATURAL HISTORY, SUPPLIED TO THE SEVERAL PARTIES OF MAJOR I. I. STEVENS.

1. *Two leather panniers*, supplied with back-strap for throwing across a mule. One of these is intended to contain the copper kettles, and their included alcohol, together with the nets and other apparatus; the other to hold the botanical apparatus, skins of animals, minerals, &c.

2. *Two copper kettles* in one of the panniers, to contain the alcohol for such specimens as require this mode of preservation, viz: reptiles, fishes, small quadrupeds, most insects, and all soft invertebrates. The alcohol, if over eighty per cent., should have one-fourth of water added.

3. *An iron wrench*, to loosen the screw-caps of the copper kettles, when too tight to be managed by hand.

4. *Two India rubber bags*, one for each kettle. These are intended to be inflated inside of the kettles, and by displacing the alcohol cause it to rise to the edge of the brass cup, and thus

fill the kettle. Unless this be done, and any unoccupied space thus filled up, the specimens will be washed against the sides of the vessel and much injured.

5. *Small bags made of lino*, of different sizes, and open at one end. These are intended, in the first place, to separate the specimens of different localities from each other; and, in the second place, to secure them from mutual friction, or other injury. The number or name corresponding to the locality is to be marked on the outside with red chalk, or written with ink on a slip of parchment and dropped inside. The specimens are then to be placed in the bag, a string tied around the open end, and the bag thrown into alcohol. The ink of the parchment must be dry before the slip is moistened in any way.

N. B.—Fishes and reptiles over five or six inches in length should have a small incision made in the abdomen, to facilitate the introduction of the alcohol. Larger snakes and small quadrupeds may be skinned, and the skins placed in alcohol.

6. *Red chalk pencils*, for marking the bags.

7. *Parchment*, to serve as labels for the bags. This may also be cut into labels and fastened by strings to such specimens as are not suited for the bags.

8. *Small seines*, for catching fishes in small streams. The two ends should be fastened to brails or sticks, (hoe-handles answer well,) which are taken in the hands of two persons, and the net drawn both up and down stream. Fishes may often be caught by stirring up the gravel or small stones in a stream, and drawing the net rapidly down the current. Bushes or holes along the banks may be enclosed by the nets, and stirred so as to drive out the fishes, which usually lurk in such localities.

9. *Casting-net*. This is sent only to the permanent station.

10. *Alcohol*. About five gallons to each travelling party. This should be about eighty per cent. in strength, and medicated by the addition of one ounce of tartar emetic to one gallon of alcohol, to prevent its being surreptitiously drunk.

11. *Arsenic*, in two-pound tea canisters. This may be applied to the moist skins of birds and quadrupeds, either dry or mixed with alcohol.

12. *Tartar emetic*, for medicating the alcohol as above.

13. *Cotton*, for stuffing out the heads of birds and mammals. To diminish the bulk, but little should be put into the bodies of animals. The skulls of the quadrupeds had better be removed from the skins, but carefully preserved.

14. *Paper*, for wrapping up the skins of birds and small quadrupeds, each separately. The paper supplied for botanical purposes will answer for this.

15. *Butcher knife, scissors, needles and thread*, for skinning and sewing up animals.

16. *Blank labels* of paper for marking localities, sex, &c., and tying to the legs of the dried skins.

17. *Portfolio* for collecting plants.

18. *Press* for drying plants between the blotting paper. Pressure is applied by straps.

19. *Very absorbent paper* for drying plants.

20. *Stiffer paper* for collecting plants in the field. The same paper to be used for wrapping skins of birds and quadrupeds, as well as minerals and fossils.

21. *Small bottles* for collecting and preserving insects.

22. *Geological hammer*.

23. *Fine shot* for birds. About No. 9 is most convenient for the purpose.

WASHINGTON, *April* 20, 1853.

SIR: In compliance with your request, I have the honor to submit, briefly and simply, a few suggestions for the guidance of your several corps, such as in my judgment will best serve to develop the mineral and agricultural resources of the interesting but comparatively unexplored region of country assigned to you for examination.

The best mode of effecting these objects would be, in the first place, to collect sufficient data for the construction of a geological section and map, showing the order and succession of rocks from the upper Mississippi river to the Pacific ocean. To accomplish this object, careful examination should be made of every exposure of rock in place on the route; the dip, or inclination from the horizontal; thickness of each stratum of rock exhibited; relative position; and, so far as practicable, the lithological character noted. Where outbursts of granite or other igneous rocks occur, through the stratified rock, observe the general range of the volcanic action; also notice the direction of veins of quartz or other minerals. Specimens for analysis should be collected at all important points. Two inches by one of surface, and half an inch in thickness, will answer this purpose. Careful barometrical observation should be made, not only of the elevations, but at regular intervals, say six times a day, along the whole extent of country. The small streams and rivers afford the best opportunity for geological investigations.

In all cases where the rocks are fossiliferous, collect two or three well preserved specimens; these would better determine the age and true position of the rocks than weeks of investigation without them; one or two perfect specimens being far more valuable than a dozen that have been rubbed or fractured.

From the Sioux river to the falls of the Missouri, on both sides of the Missouri, you pass through the cretaceous and tertiary formations, perhaps as rich in fossil remains as any other region in the country, or it may be in the world.

Microscopic organic deposits, recent and fossil, are occasionally met with. These infusorial remains are sometimes found in layers of considerable thickness, and are well worthy of careful investigation. These rocks are silicious and calcareous, usually of a yellowish tinge and somewhat friable, and have been found in the banks of the Missouri, and in the beds of several of its small tributaries. Small specimens should be collected.

All discoveries of valuable ores, or useful minerals, clays, marls, saline and chalybeate springs, &c., should be located, when practicable, by the distance and direction from some prominent geographical feature of the country, as mountain, river, &c., and specimens be collected for analysis. In connexion with this subject it is highly important that a series of observations be made on the dip and intensity of the needle, as intimately connected with the geological and mineralogical character of that region of country, and as likely to lead to results interesting to the cause of general science. Note carefully at all times whether there are such indications of valuable minerals as would render expedient a further examination.

All specimens of rocks, minerals, and fossils, should be wrapped in strong paper, with a label of the locality inside written in ink, and packed sufficiently tight, either in bags or boxes, to prevent rubbing. Crumbling fossils may be preserved by soaking them in a thin solution of glue or gum arabic.

Specimens of soil for analysis should be collected, and the sub-soil noted, in prairie and bottom land, throughout the entire route; at least on every change of surface rocks, as you pass over the various geological formations, from the magnesian limestone and lower sandstone of the St. Peter's river, through the vast drift region extending to the Sioux river of the Missouri, through the various chalk marls, sandstones, plastic clays and slaty clays of the cretaceous formations, the limestone coarse conglomerates and silicious clays of the tertiary period, on to the comparatively fertile strip of land caused by the decomposition of the older limestones of the Rocky mountains and the vegetable matter washed down from their various slopes, to the basaltic soils of Middle Oregon, occupying three hundred miles in extent, and, crossing the Cascade range of mountains, to the tertiary soils of Western Oregon. Each of these soils, so different in their constituents, produces different grasses, wild flowers, and trees, and is more or less adapted to various agricultural purposes. Hence the vast importance of a careful analysis of these soils in advance of the settlement of the country. Bags, made of ticking, holding from a pint to a pint and a half, are best suited to a preservation of these specimens.

They should be numbered, and a corresponding number entered in the note-book, with a particular description of the localities.

It will not be necessary to make geological collections, except of soils, until you reach Traverse des Sioux, as the exploring parties of Dr. Owen have already determined with sufficient accuracy the geology of that district. But after crossing the extensive drift region before alluded to (where it is only important to notice the underlying rocks) you come into the rich fossiliferous regions of the cretaceous and tertiary formations. Here it is of great importance to make careful geological sections of the rocks exposed, and to collect all the fossil remains met with, in order to determine with greater accuracy the boundary of these formations, and as far as practicable of their various members. As before stated, they extend to near the falls of the Missouri, and this is the only portion of the route where it is particularly desirable that *extensive* geological collections should be made. All specimens collected in this region you are requested to deposit at Forts Union and Benton, carefully packed in boxes for shipment down the Missouri river, and directed to ———.

An interesting feature in the geology of the upper Missouri river country is the great lignite bed, commencing about latitude 47°, and showing itself at various points on the Missouri river for seven hundred miles. In this vast prairie country, almost wholly destitute of timber, it is important that the quality and extent of this coal bed be determined. Specimens, therefore, should be collected, both of the coal and the rocks associated with it.

Special attention is directed to the geological formations along the base of the Rocky mountains, both east and west of the main range. The age of these rocks has been a matter of some doubt; and it is highly important, if any of them are fossiliferous, that collections be made.

The Bitter Root range of mountains is perhaps the most interesting portion of your route for mineralogical research. I collected here rich specimens of iron, copper, and other valuable and useful ores; and in some portions of the range the rocks bear considerable analogy to the talcose and other allied rocks of the gold-bearing regions of California.

As you proceed northward a considerable change occurs in the geological features of the country. Galena, of good quality, has been found near Fort Colville, north of the British line. If these seams extend into our own territory, it would prove a discovery of great value, and it is therefore worthy of investigation.

West of the Cascade range of mountains, on the way to and from Puget sound, your parties will pass and repass through the great coal or lignite region of Washington Territory. The beds are of greater thickness and better quality than have been found in the same geological formation in any other country, and may prove of great value. It is my intention to spend several months in the exploration of that section, but the incidental information obtained by your numerous corps might be of great advantage in developing the extent and value of these deposits.

Very respectfully,

JOHN EVANS,
Geologist of the Expedition.

Gov. Isaac I. Stevens.

Camp Pierce, *June* 3, 1853.

Sir: I reached St. Paul's on Friday evening last (May 27,) and the next morning went to the camp which had been established by Captain Gardiner, some three miles from Fort Snelling, west of the Mississippi river; and which, in honor of the President, I have named Camp Pierce.

The camp was established by Captain Gardiner on the 24th of May, the day after the arrival of the full list of mules, one hundred and seventy-two in number; and on the 25th ultimo the whole expedition was brought together, with the exception of Mr. Stanley, the artist, Mr. Osgood, the disbursing agent, Mr. Evans and Mr. Kendall, two aids of the expedition, and myself. About one-half of the mules had never been broken, either in wagons, to pack, or saddle, and the remaining half were quite wild, and required much work to prepare them for service. In consequence of these difficulties, and there not having been engaged a sufficient number of teamsters, some delay has necessarily occurred in setting out.

Captain Gardiner and Lieutenant Grover have been indefatigable in their exertions, and, considering the difficulties that have been encountered, great progress has been made.

On Tuesday, (May 31,) the two civil engineers, Mr. Lander and Mr. Tinkham, were sent out with small parties to commence the survey of the railroad route. Their riding-mules, as well as all the riding-mules of the gentlemen of the party, have been broken by themselves with very little additional assistance, several of the younger members of the party having only succeeded in mastering their animals after having been thrown several times. Mr. Lander, the morning he set out, was thrown, and had his shoulder put out of joint. It was brought back by the main strength of three men, and he immediately set out at the head of his party.

I refer to these facts to show the spirit of my command, and the promise thus given that all difficulties must disappear before the hardihood and the resolution thus exhibited. All this has been done in the midst of drenching rains. It has rained since Tuesday, till to-day.

Mr. Lander had previously made a reconnaissance of the several crossings of the Mississippi, for the details of which I refer you to the enclosed copy of his report. I also enclose the instructions given to Mr. Lander and Mr. Tinkham, in relation to their respective duties.

To-day I sent off a small train of three wagons and twenty-four pack-mules to a depot and station which I propose to establish west of the Mississippi river, near the Sauk rapids. The mules were the wildest of the whole number, and were packed for the first time, yet they reached their camping ground, setting out at 11 o'clock, a distance of six miles, in season to picket the animals before sundown. To-morrow I shall send off a small train, and on Monday the whole camp will be in motion.

Proceeding with the astronomical and magnetic party, I shall take the steamer at St. Anthony, and reach the depot west of the Sauk rapids on Tuesday evening, and there establish a station, which, with the observations at this station, will connect with Nicollet's survey, and give a good base on the Mississippi river. I shall reach the depot in season to make arrangements for the whole command to cross the river, and at the same time be in easy communication with Mr. Tinkham and Mr. Lander. The whole command will, I trust, be on the west side of the Mississippi on Saturday next, June 11, and on Monday I hope to be able to push rapidly into the interior.

Lieutenants Du Barry and Grover have been indefatigable in preparing themselves for their duties, practising at all the observations and computations. They will be able, on leaving the Mississippi, to take command of sub-parties, and make in person all the observations.

Before leaving this depot, I will again communicate with the department, and state more specifically how I shall organize the several parties, particularly those under Lieutenants Du Barry and Grover.

I am, very truly and respectfully, your obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

ST. PAUL'S, *May* 22, 1853.

SIR: In receiving your instructions in regard to a reconnaissance of the upper Mississippi for a railroad crossing, I was directed to view this subject with reference to a feasible connexion with Lake Superior; to choose a point which should not interfere with steamboat navigation, and one that would occupy a favorable position for joining the main line east. With these quite definite instructions to guide my examinations, I have made an actual reconnaissance of the river from St. Paul's to Fort Ripley, and beg leave to submit the following report:

At the ferry near falls of St. Anthony, at the rapids near mouth of Sauk river, at several points for two miles above these rapids, at the ferry near Swan river, and at Little Falls, I have found locations for crossing the river with a railroad bridge. The first of these, near the falls of St. Anthony, is about eight hundred (800) feet. It does not occupy so favorable a position, in regard to a connexion with Lake Superior, as either of the other points. The crossing is much greater in length, and the quantity of masonry larger than at those farther north. The cost of this masonry is excessive, from the necessity of bringing the material for construction from Sauk rapids. The distance to "Dead Colt Hillock"—a point near the course of survey—is not less by this crossing than by passing over the fine gravel country east of the Mississippi to Sauk rapids. The water is deep, and the current much more swift than at any of the other points. Passing west, the country is thickly wooded, springy, entirely impassable for wagons, and inducing additional cost in grubbing and culvert masonry. I deem this crossing the least favorable of those I have examined. Eighty miles north of the falls of St. Anthony, at the head of steamboat navigation, and near the mouth of Sauk river, occur several favorable crossings, nearly similar in character. These, with the routes connected, should at some future period be subjected to a careful survey; the limited time allowed for the present examination necessarily confining my attention to reconnaissance.

The first of these, near the mouth of Sauk river, is about five hundred (500) feet. By encountering the rapid current near the falls, excellent foundation for bridge masonry can be obtained upon the granite ledge of the section. Within two (2) miles are five other points, none exceeding six hundred (600) feet in length. The adjoining ledge furnishes granite of suitable quality for heavy masonry.

I have estimated the cost of a bridge at Sauk rapids, for a road-bed of twenty (20) feet, as follows:

500 feet of Howe's truss, at twenty-five dollars ($25)	$12,500
1,353 cubic yards of bridge masonry, at twelve dollars ($12)	16,236
Repairing foundations, say	1,000
	29,736

Five miles farther north, near the mouth of river Watab, occurs a crossing four hundred (400) feet in length, with excellent foundations of granite ledge. This crossing is so situated as to induce cutting of about twenty (20) feet in hard material; upon the east shore of the river; say twenty thousand yards at forty (40) cents, or $8,000. The adjacent ledge not being of suitable quality for building, the material for masonry must be brought from Sauk rapids. The location is neither so feasible of approach, nor in facility of getting west, as that at Sauk rapids, although the passage of the river is shorter, and the current not so swift.

Twenty-four miles north of Watab, near the mouth of Swan river, is a crossing four hundred and fifty (450) feet in length. It has no advantages over those at Sauk rapids. The abutment foundations must be obtained by piling; pier foundations adjusted by coffer-dam or winter crib-work. The current is not swift, the water about eight feet in depth. Four miles north of this point, at the island near Little Falls, is a very fine crossing of three hundred and twenty-five (325) feet.

Four wing abutments and a slight increase of truss will be required, from the destructible nature of the ledge foundation, which is slate rock, strongly impregnated with iron, and affected by the atmosphere. Two short bridges would be necessary—one, of one hundred and twenty-five (125) feet, crossing the east branch of the river to island; thence embankment of one hundred and fifty (150) feet; thence bridge span of two hundred (200) feet, over main channel of the river. The actual width of the main channel here is one hundred and seventy-five (175) feet, and the whole crossing the best upon the Mississippi from St. Paul's to Fort Ripley. The boulders of the hill-sides in this vicinity afford good granite for light masonry. The magazine at Fort Ripley is built of these boulders; but they are not abundant, neither do they furnish blocks of sufficient size for exposed bridge abutments. The material for this purpose must be brought from Sauk rapids, thirty-two miles below. The country on the east side of the Mississippi, from St. Paul's to Little Falls, presents facilities for railway construction I have never seen exceeded; one hundred and twenty miles of level, or slightly rolling gravel plain, supersedes all necessity for ballasting, and affords peculiar advantages for forming an embankment road-bed—the very best mode of construction for guarding against the snows and frosts of a northern climate.

Passing west from Little Falls, I find no serious difficulty to encounter over a route which had been represented to me as very severe. The country, to be sure, is broken, the ground springy, and the cost of moving material will evidently exceed that of the line east of the Mississippi. There is a greater quantity of earth to be excavated, and quite an increase in the amount of culvert masonry; still the surface presents a favorable aspect for good alignment. No cut will exceed twenty feet. There is no appearance of ledge, and by exercising some degree of care in the location an excellent route can be obtained.

I have no knowledge of this line extending beyond Long Prairie. It is represented to me as broken into sharp ridges, very swampy, and quite thickly wooded.

Summing up this matter, it seems evident that the proper course of the survey would be from St. Paul's up the eastern shore of the Mississippi to Sauk rapids, thence near the Red River trail towards the head-waters of the Sauk. Sufficiently reliable information is afforded to prove to us that a very excellent route can thus be secured.

The passage of the Mississippi is made at a point that does not interfere with steamboat navigation. It affords all necessary advantages to a communication with Lake Superior, is in a favorable position as regards an eastern connection, and will thus insure the proper direction of capital in the location of private lines. The crossing at Little Falls is nearer a direct route from the Pacific to Lake Superior, and therefore worthy of serious notice; yet it is evident that the interests of private companies should not be neglected, and that those operations should be fostered which, in efforts to develop the resources of this rich inland country, will add their share to the importance of our great enterprise, and aid in bringing it to a successful termination. Passing through a country already forward in vegetation, and presenting every facility for expediting progress of survey, the route at Sauk rapids is superior to all others in the features required by your letter of instructions.

Submitting this result of my examinations, I remain, with respect, your obedient servant,

F. W. LANDER.

Gov. Isaac I. Stevens,
Chief N. P. R. R. Exploring Expedition.

Camp Pierce, *May* 31, 1853.

Dear Sir: You will immediately proceed to St. Paul's, and at once commence the survey of a railroad route, and proceed northward on the east side of the Mississippi river, crossing said river at the Sauk rapids, making a reconnaissance of the country over which you pass, and directing particularly your attention to the examination of the river crossings.

At Sauk rapids you will direct your attention to the investigation of the best method of, and securing the means for, the crossing of the main party, which will follow in a few days. You are authorized to employ men, secure boats, and to procure the best means to accomplish this object; and the arrangements which you make you will communicate to me at the earliest practicable moment.

From Sauk rapids you will continue your reconnaissances of the country westward, examining the various routes. You are not confined to any specific route, but, keeping in mind the line over which the main train will pass, much is left to your own judgment.

In the map of Nicollet, accompanying this, several probable routes are laid down: one crossing the Cheyenne river but once, and passing just south of the Miniwakan lake; a second crossing the river twice, and passing some twenty or thirty miles south of the lake; a third keeping at the headwaters of the southern tributaries of the same river, in the general direction of Dead Colt Hillock, and north of the Coteau des Prairies. All these routes, there is reason to believe, can be pursued, and they are referred to simply to call your attention to the magnitude and extent of the work of the expedition through that region. You will endeavor to keep me advised of your movements, and may expect me to join you before you have advanced far into the interior.

You will give special attention to the several river crossings on the Red river trail, so far as it will be pursued by the main party, and will make such arrangements for the crossings as you may deem advisable.

Endeavor to replace the two teamsters sent with your wagon to-day, and send them back to camp; send in all the good men you come across. Engage none but hardy fellows to assist you, and such men as will be useful in the whole expedition, should their services be needed. Purchase the four-mule team at Fort Ripley, and have it at Sauk rapids for the main party, with two good teamsters.

I am, very truly, &c.,

ISAAC I. STEVENS.

F. W. Lander, Esq.

Camp Pierce, *May* 31, 1853.

Dear Sir: You have already received verbal instructions to take the field to-day and enter upon your duties as one of the associate civil engineers on the northern Pacific railroad exploration.

The general course reconnoitred by your associate, Mr. Lander, east of the Mississippi river, from St. Paul's to the crossing of the Mississippi above the Sauk rapids, will be pursued by you; and, whilst you will collect as much data in reference to the details of the construction as practicable, you will arrange the scale of it so that with your present force, with a few days' experience, you will be able to make fifteen or twenty miles per day.

You will connect the camp, and the magnetic and astronomical observations, with your route; and at each camping-ground leave some mark, as a blazed tree, whereby future observations can be connected with your work. You will also note in your journal good points for camping, with brief notes as to grass, water, and wood for camp-fires. Keep up the sketches with care. The variation of the needle will be furnished in season.

You will probably reach the Sauk rapids a day or two in advance of the main train, and will be able to make a rapid instrumental survey of the same. I have instructed Mr. Lander to make arrangements for the crossing at that point; and should the main body not reach you, you will cross the river without delay and work westward.

Should you, on special occasions or for permanent services, find it necessary to engage more men, you are authorized to do so—recollecting that it will be necessary, so far as practicable, to reduce the scale of the work, abridging the quantity of the data, rather than to increase the force.

A written report will be required, to include the crossing of the Mississippi; and I will suggest that, so far as practicable, it be simply your journal. It seems to me, that with a brief introductory memoir, it will be just the thing that is to be desired.

Send to camp all the good men you find; we are very deficient in force.

Yours, truly,

ISAAC I. STEVENS.

A. W. Tinkham, Esq.

Camp Davis, near Sauk Rapids,
June 10, 1853.

Sir: Having on Saturday and Sunday, June 4th and 5th, sent forward two small parties of wagons, and a party with the mountain howitzer and five dragoons, I broke up my camp on Lake Amelia (Camp Pierce) on Monday, June 6th, and sent the command forward in three parties: one under Lieutenant Grover, consisting of the astronomical, magnetic, and meteorological party, were sent on the steamer that plies between St. Anthony and Sauk rapids, with directions to land on the west side of the Mississippi river, below the mouth of the Sauk river, one of its western tributaries, and, crossing the ford, to establish an astronomical, magnetic, and meteorological station on the Red river trail; the second, under Lieutenant Du Barry, consisting of Mr. Stanley, the artist of the expedition, Dr. Suckley, the surgeon and naturalist, Mr. Le Frambois, the guide, a sergeant and fourteen dragoons; the third consisting of the train in charge of Mr. Everett, the quartermaster and commissary clerk. I remained in St. Anthony until about noon of Tuesday, to secure the services of several voyageurs; and particularly of Pierre Boutineau, the great guide, and Menoc, the great hunter; in which I was successful. Taking a rapid conveyance, I pushed forward forty miles the same day, passing all the parties on the road, and reached Sauk rapids, a distance of seventy miles, on Wednesday, at 11 o'clock a. m. Lieutenant Grover landed as directed, on Tuesday evening, and being somewhat incommoded by rains, did not establish his camp till yesterday.

Yesterday afternoon I pushed forward with Boutineau, the guide, and reached the civil engineers, eighteen miles ahead, at Cold spring; in company with whom, towards night-fall, I rode to the crossing of Sauk river and back—eight miles. One bad place near the camp has been placed in good condition. There are two other bad places in the road, which I am confident can be made practicable for wagons in a few hours; and I think the civil engineers will be beyond the river Sauk to-day.

I returned from the civil engineer camp to Camp Davis this morning, and shall in an hour go to the east side of the Mississippi river, at Sauk rapids, to make provision for the crossing of a portion of the train. Lieutenant Du Barry is hourly expected. The remainder of the train will hardly cross the river till Monday.

We made very good observations of all kinds at Camp Pierce, and the promise is good here. The railroad examinations, pushed fifteen or twenty miles a day, are satisfactory. The artists have been much occupied, and in the natural history department we have made quite a collection.

No delay shall occur here. The animals will not be pushed, but kept in motion. They are, generally, well broken—thanks to the spirit and determination of the command. I have not yet entirely arranged my plans; all I can do is to see what a day will bring forth, bringing to the duties of each day all that previous experience has suggested.

I will write again as I leave the Red river trail, and will send in a more elaborate report.

I am, very respectfully, your obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

Hon. Jefferson Davis,
Secretary of War.

CAMP MCCLELLAND, WEST SIDE OF CHEYENNE RIVER,
July 4, 1853.

SIR: The train from Pembina and the Red river, on their way to St. Paul's, passed the surveying party on the 2d instant, and I embrace the opportunity again to communicate with the department.

My last letter, in regard to the progress of the expedition, was written on the eve of leaving Camp Davis, since which time we have made rapid progress into the interior. The command has now become thoroughly organized, with broken animals, and hardy willing men. I feel the utmost confidence in accomplishing the great objects of the expedition.

Besides the difficult task of breaking-in wild animals, many too young for the service, and the still more difficult task of getting into working condition those run down in the operation, we have had to encounter bad roads, muddy sloughs, river crossings—consuming each an entire day—and drenching rains.

But for a few days the weather has been good. To-day we shall reach the Maple river and enter upon the high rolling prairie. The worst portions of the road are gone over. The grazing is remarkably fine. Every man is now mounted, and we shall now make our regular marches of fifteen to twenty miles per day.

But to return to Camp Davis. On the 12th of June I despatched Lieutenant Grover, with a picked party of some fifteen men, with instructions to reconnoitre carefully the country north and in the vicinity of White Bear lake, with the view of ascertaining the point where the expedition should leave the Red river tract, and indicating that it was desirable to run from that point north of Lake Traverse to the Dead Colt Hillock, and thence to the Yellowstone. The remainder of the party followed on the 13th, 15th, and 16th; and on the 23d the whole party was in camp at Pike lake, a few miles north of White Bear lake.

Here we remained till Saturday, and made our final arrangements for the march to the Yellowstone. Some inefficient men were sent home; and a detached party of nineteen picked men, two wagons, twenty-six mules, and four horses, under Lieutenant Grover, was organized to explore the line he was sent forward from Camp Davis to examine. He moved on the morning of the 23d, in fine spirits, determined to distinguish himself. I was then confident, and am still, that he will pass over a fine route. It is an almost irresistible inference, from the general course of the streams as laid down on Nicollet's map. His instructions are to push forward to the Yellowstone, touching, if possible, the Missouri, to connect with Lieutenant Donelson's survey.

I moved also on the 23d with the main train, and crossed the Cheyenne early on Saturday morning, (July 2.) We have moved rapidly; one day making, to reach wood, a march of twenty-seven miles. We bridged the Wild Rice river, and found a good bridge on the Cheyenne, the work of our Red river friends.

The train is now in motion, and I am behind to make up a mail, the last till I reach the Yellowstone. We shall cross the Cheyenne a second time a few miles north of Bald Hillock creek, and shall pass within fifteen or twenty miles of Miniwakan lake. Thence our course will be nearly straight. With my reconnoitring force I hope to cover a broad belt of country, connecting with Lieutenant Grover's route. The accompanying sketch will show the character of our work. It is all the result of careful observation. The work north of our route, on the Bois de Sioux, Wild Rice, and Red rivers, was done in a single day, by Mr. Adams, a young gentleman attached to the civil engineers' party: that west of our present camp, on the Cheyenne, by Mr. Lander, one of my civil engineers, assisted by Mr. Adams and one man. Mr. Lander left this on Saturday afternoon, at four o'clock, and returned last evening a little after eight—riding eighty miles in twenty-eight hours, and carefully observing for all that distance.

By a comparison with Nicollet's map, it will be seen that the course of the Cheyenne at its southern bend is much out of the way, and I have determined to have its southern shore carefully examined by Mr. Lauder. He will accordingly start to-day, with Mr. Adams and four picked men, on his duty; and he will be instructed carefully to explore the region along, and south and west of, the Cheyenne river, connecting, if possible, with Lieutenant Grover's route. He has choice animals and spare horses for reconnoitring. I entertain no apprehensions as to hostile Indians. He will join me south of the Miniwakan lake.

The sketch indicates the course of Lieutenant Grover, of my proposed course to the second crossing of the Cheyenne river, and the relative position of the two routes to the direct course from the Sauk crossing to the mouth of the Yellowstone.

The country thus far is exceedingly favorable for a railroad. I am confident no grade to this point will be found of more than twenty feet. The Cheyenne is a great obstacle, and the indications are very decided that the line must go south. I have indicated a practicable railroad route. Its cost, without equipment, will not exceed twenty thousand dollars per mile. No important deflection is made. The crossing of the Cheyenne at this point would cost, say one hundred thousand dollars. Twenty miles west, at the point A, not fifty thousand dollars. The line by Dead Colt Hillock will, I think, be better. But when I reach the Yellowstone and have Lieutenant Grover's work before me, I shall be able to report more definitely on this portion of the route.

I must make my acknowledgment for the promptitude and efficiency shown by the civil engineers, Mr. Tinkman and Mr. Lander, in the work on the railroad explorations.

Very truly yours,

ISAAC I. STEVENS,
Governor, &c., in Charge of Expedition.

Hon. JEFFERSON DAVIS,
Secretary of War.

CAMP CUSHING, NEAR FORT UNION,
August 8, 1853.

SIR: I have the honor to report to the department, that since the date of my last communication at Camp McClelland, upon the Cheyenne river, the party has advanced with rapid marches up to this point, where we arrived at noon on August 1st. The detached party under Lieut. Grover, which was referred to in my communication as having been despatched by a southern route by the Dead Colt Hillock, arrived six days in advance of us, with information concerning the route of the most satisfactory character. The animals are all in fine condition; our marches the last nine days having exceeded an average of twenty miles, and but two are at this time unserviceable. The very short time to make up my mail at this time—as the steamer, which only arrived last evening, returns at noon to-day—will permit only the brief statement of our general success, reserving a full report until my arrival at Fort Benton.

A broad belt of country has been thoroughly examined, the courses of Cheyenne river, and of the valley of the Mouse river, have been brought in by side reconnaissance, and excellent practicable routes for a railroad ascertained. From this point I shall move to-day for Fort Benton, which will be reached in twenty-five days. The command will be divided into two parties, one under my own supervision, with Lieutenant Grover in charge of the scientific details, taking the usually travelled road by Milk river, and the second under Lieutenant Donelson, pursuing a route some fifty miles to the northward, on which the most prominent landmark is the Cypress mountain, in which rise streams flowing into both the Saskatchewan and the Missouri rivers. I have secured excellent guides, by one of whom I am assured that he will lead us to a pass in the mountains through which the whole wagon train can be taken—a pass through which, from Fort Benton to the St. Mary's village, an express train can move in four days, a pack train in seven, and a wagon train in fifteen days. Everything looks extremely favorable, and I doubt not in the least that by the last of September we shall have crossed the mountains. As regards the Indians, I take pleasure in reporting that we have met two large encampments of Assiniboins, by whom we have been received with unbounded hospitality. In reference to the Blackfeet, whose country we are now about entering, I am assured by Mr. Culbertson, my special agent for that tribe, that they will receive us with open arms, and that no trouble need be apprehended. The necessary precautions will, of course, be taken to secure against attacks and loss of animals, but I can see no reason to apprehend the slightest trouble with any of the tribes to be met upon the route.

The enclosed memorandum will give you a more full account of the details of the operations, and the enclosed sketch of a railroad route certainly practicable, at a cost probably not exceeding $40,000 per mile. It is certain that the two great key points of country are the valley of Mouse river and the region of the Bois des Sioux. The Mouse river is erroneously given on all the maps. It nowhere approaches the Missouri nearer than thirty or forty miles, and the pass over the Coteau is so gradual, and the whole valley is so open, that the ascent is scarcely observed.

I must not fail particularly to advert to Lieutenant Donelson's excellent survey of the Missouri river, as high as the boat has been navigated the present season, some one hundred and twenty miles above this point, and the numerous collections made by him on the route; and to a very extended reconnaissance of the White Earth river, and the Coteau de Missouri, during which, in nine days, he passed over a distance of two hundred and thirty-five miles.

A more detailed account will be given hereafter. I shall from Fort Benton make report on the navigability of the Missouri, with suggestions for, and an estimate as to its improvement.

T. S. Everett, Esq., the quartermaster and commissary clerk of the expedition, returns from this point to Washington, and will call on you personally, to give you information which I cannot embody in a report at this time.

I am, sir, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory.

Hon. JEFFERSON DAVIS,
Secretary of War.

N. B.—The memorandum I regret I cannot prepare in time, and shall have to refer you to Mr. Everett for additional particulars which cannot be found in this brief letter.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Benton, Upper Missouri, September 8, 1853.

SIR: We left Fort Union on the 9th of August, and pursued the Milk river line, abandoning the two lines contemplated in my letter of the 8th of August. The junction of the two parties was made at the Big Muddy river, and resulted from my inability to furnish proper transportation and the requisite force to the two parties. The train moved forward under my charge until the 24th of August, when with a small party, including Alexander Culbertson, Esq., the special agent among the Blackfeet Indians, and accompanied by two select detached parties under the respective directions of Lieut. Grover and Mr. Lander, I started in advance, and arrived here on the 1st instant.

We found that the Missouri is much out of place on all the maps, and the Milk river still more so—flowing nearly due west. Up to this point, we have found the country entirely practicable for a railroad. Whichever pass in the mountains may be decided upon, the Milk River valley will furnish a good approach.

Dr. Evans, geologist of the expedition, arrived here on the 5th instant, having made a complete and satisfactory examination of "Mauvaises Terres," the country south of the Yellowstone from the Black hills to the Missouri river, and north of the Missouri, between the Milk and Missouri rivers.

The main train reached here on the 6th instant, the animals in excellent condition, and the men all anxious to press forward to the mountains: the command is a unit, and none are desirous to turn back.

Already are my parties ahead, examining the country between here and the mountains. Lieut. Grover, with a select party of seven men, started on the 5th to reconnoitre Cadotte's Pass, and ascertain its practicability for wagons, and open the communication with Captain McClellan.

Mr. Lander, the estimating engineer, with a small picked party, has gone northward to make a thorough examination of the Marias Pass, and a reconnaissance of the country to the Kootenaies post. This pass is said, in consequence of fallen timber, to be almost impracticable, and is here pronounced to be the most difficult of the three passes to be examined.

Lieut. Mullan, with a small party, has gone to the Flathead camp, on the Muscle Shell river, about a hundred miles south of this point, where procuring good Flathead guides, he will go through a third pass, and join the expedition at the St. Mary's village.

Lieut. Donelson will leave to-day with an advance party of twenty-five men, two wagons, &c., making a thorough survey and reconnaissance of the approaches to Cadotte's Pass, and make the road practicable for the wagon train which will follow on the 11th instant, and overtake him at the foot of the first dividing ridge.

I shall, with a small party, start to-day for the Piegan camp at the Cypress mountain, some hundred and twenty miles northward, passing along the base of the mountains. I shall make an examination of the approaches, and, returning to this point, overtake the train before it reaches the St. Mary's village.

No apprehensions are felt as to snow: there will be none during the coming month, and the first fortnight of the following, except on the mountain peaks. I am determined, if practicable, to push my whole wagon train through. On reaching the St. Mary's village, I shall establish a winter post, in charge of Lieut. Mullan, to operate in the passes of the mountains, till driven out by snow, and then to explore the lateral valleys and passes, examining the country southward to Fort Hall, to connect the survey with Fremont's, and northward to the Kootenaies post, under the 49th parallel.

In addition to the reconnaissance of Cadotte's Pass and opening the communication with Capt. McClellan, Lieut. Grover is instructed to return to Fort Benton, make a survey of the Missouri river from the Falls to the Milk river, connecting with the survey of that river by Lieut. Donelson, and, returning to Fort Benton, get up a dog train and cross the mountains in the month of January. The winter post under the charge of Lieut. Mullan, besides furnishing the means of obtaining valuable meteorological information, is essential to the success of the dog train of Lieut. Grover.

The labors of the survey up to this point have been of the most satisfactory character, and attended with entire success, besides examining a large field of country, and establishing the entire practicability of a railroad. The Missouri river is believed to be navigable at all seasons of the year, except when obstructed by ice, to the Falls of the Missouri, for steamboats not drawing over eighteen inches of water. Slight obstructions may occur which can be removed at a comparatively small expense. The survey of the Missouri river from the Falls to a small distance below Milk river, where Lieut. Donelson's labors terminated, will be taken up next month by Lieut. Grover, and continued. On their joint labors and collections a reliable report on its navigability will be based.

I have the honor to be, very respectfully, your obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Benton, Upper Missouri, September 8, 1853.

SIR: Dr. Evans, the geologist of the expedition, will precede me through the mountains, and going with a light pack train, will reach the mails a fortnight before me. I have made every exertion to prepare my accounts in season for estimates for Congress, at the commencement of its session; but having not yet even met or communicated with the parties west of the mountains, I can only make a conjectural estimate. With great exertion on my part to reduce expense and to push through my operations, I am obliged to report that the allotment made of $40,000 from the appropriation for the survey will be entirely exhausted by the close and perhaps by the middle of next month. I do not feel justified to suspend operations. We are on the eve of complete success. My parties are now exploring the passes of the mountains. My intercourse with the Indians has been of the most satisfactory character. The Blackfeet Indians have sent their chiefs and braves to invite me to their camps; not a horse has been stolen, not a man touched; no private article has been missed. They have brought our disabled animals into camp, and acted as guides and guards. These Indians sent their war parties to the California trail, and horses believed to be stolen from our emigrants by the Crows are actually taken to the camps of the formidable Blackfeet, under the 49th parallel. To-day I set out with a small party, with Mr. Culbertson, the special agent, to visit a large Piegan camp at their most favorite resort, the Cypress mountains, one hundred and twenty miles north of this point. My object is twofold: to secure guides for the examination of the Marias Pass; and to bring about a general pacification of all the tribes north of the Missouri, and those immediately west of the mountains, on the basis of the treaty of Laramie. I shall, in a letter of this date to the Commissioner of the Indian Bureau, recommend a council to be held next year at some suitable point, say Fort Benton, and shall urge the passage of an appropriation of money to defray the expenses. I do not doubt that complete success will attend it, and that hereafter a single man will be able to go unmolested through these vast plains.

In view of the great results which I am of opinion this expedition is on the eve of accomplishing, I do not feel that I would fulfil the reasonable expectations of the department by suspending operations. It seems to me my highest obligation is to continue vigorously the work placed in my charge, and to get results which will justify the expenditure of means. Believing that the department and Congress will sanction this course, I shall vigorously pursue the work, reducing the force on the approach of winter to the smallest amount compatible with an efficient winter organization, and one which in the spring can at a moment be increased for a full resumption of the work. This I will earnestly recommend. An instrumental survey should be made of the best mountain passess, both of the Rocky mountain and Cascade range. The intermediate lines should be reviewed. The astronomical, magnetic, and meteorological observations should be continued. A large expenditure has been made; trained men are in the field, and all the appliances are at hand. I shall not suspend the work till I receive the instructions of the department to this effect.

Estimate for continuing the work to the close of the present fiscal year is, monthly, as follows:

October 15 to 30, 1853	$2,500
November, 1853	5,000
December, 1853	3,000
January, 1854	3,000
February, 1854	3,000
March, 1854	3,000
April, 1854	3,000
May, 1854	3,500
June, 1854	4,000
	30,000

Estimate for fiscal year ending June 30, 1855, $40,000.

In addition to the above, I am satisfied that the Missouri can be navigated by steamers to the falls above this place, and I would recommend an appropriation of $10,000 to test the question next year. The Indian Bureau needs a steamer exclusively for its own use.

RECAPITULATION.

For continuing the exploration and survey of a route for a railroad from the headwaters of the Mississippi to Puget sound, including the thorough examination of the passes of the mountains during the winter, and including a steamer to determine the practicability of navigating the Missouri river to the falls, for the fiscal year ending June 30, 1854, $40,000.

For continuing the survey of a route of a railroad from the headwaters of the Mississippi to Puget sound, including an instrumental survey of the best mountain passes, for the fiscal year ending June 30, 1855, $40,000.

I have the honor to be, very respectfully, your obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration and Survey.

Hon. JEFFERSON DAVIS,
Secretary of War.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Benton, Upper Missouri, September 8, 1853.

SIR: I have to request that $10,000 still remaining in the treasury, of the sum allotted to me from the appropriation for the survey of the several routes for a railroad from the Mississippi river to the Pacific, be drawn out and placed on deposit, subject to my order, with the Treasurer of the United States.

In a report of this date, I have made estimates for continuing the survey the present year, and have recommended that an appropriation of $40,000 be asked of Congress. I will earnestly request that, from existing appropriations legitimately applicable to such a purpose, a portion of this sum be drawn out and placed on deposit with the Treasurer of the United States, subject to my order, and that I be advised of the action of the department at the earliest practicable period. Communications should be sent to me at Olympia, Washington Territory.

I regret I cannot go into more details at this time. But at this moment I feel that I must throw my energies into the almost herculean task before me, and send in careful estimates on reaching Puget sound.

I have the honor to be, very respectfully, your obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War.

CAMP AT KETETAS, ON YAKIMA RIVER,
September 18, 1853.

SIR: I have the honor to report that, in consequence of the great detentions caused by the miserable quality of the animals and pack-saddles with which I was provided, and the difficult nature of the country through which we have passed, I was unable to reach the valley of the Wenass (a branch of the Yakima) until August 20. Hearing, from what seemed good authority, that there were numbers of government mules at Steilacoom, and that the trip could be made in five days, I at once sent in my pack-horses to be exchanged, and to bring out provisions to enable me to start from here with three months' supplies; intending to occupy myself, in the meanwhile, in examining the passes near Regnier. On my return from the

Nahchess Pass, I received an express from Lieutenant Hodges, informing me that most of his horses had given out, and that there were no spare mules at Steilacoom. I therefore at once determined to reduce the size of the party, and on the next day sent in the escort and packers enough to reduce the number from sixty-eight to about thirty, for which number I can carry the requisite supplies on mules. The Nahchess Pass is at the head of the river of the same name, (the south fork of the Yakima,) about fifteen miles north of Regnier. The lowest point of the divide is 4,966 feet above Vancouver; the divide quite narrow, the ascent in the upper eight miles of the valley 1,612 feet. The valley is frequently reduced to a mere cañon, wholly occupied by the bed of the stream. Judging from the snow-marks on the trees, and information received from the Indians, the snow accumulates to great depths in the narrow valleys—I should suppose at least twenty feet—and upon the mountains some five to six feet.

Lieutenant Hodges reports the valley on the west side as sloping with great rapidity for about twenty miles from the summit, and as presenting no great difficulties thence to the sound. The pass at the head of the main Yakima, (the Snoqualme Pass) some twenty miles north of the Nahchess Pass, is but 3,544 feet above Vancouver. On the lowest point of the summit is a shallow lake, about two hundred yards long, from which the water runs both ways. From this lake to the west the descent is exceedingly rapid. Towards the east the descent in the distance of about three quarters of a mile is five hundred and thirty feet to another lake about half a mile long; from this to the large lake in which this river heads—a distance of about two miles in a direct line—the descent is five hundred and ninety-nine feet. From this last lake (Kitchelus) there is no difficulty in the way of the construction of a road of any kind; the valley of the river being generally wide and level, but covered in the upper part by a dense growth of timber. The snow must accumulate to about the same extent as in the other pass; but the valley on the east slope being more open, the obstruction would be much less on this route. Being exceedingly pressed for time, I was unable to proceed more than a few miles beyond the divide in the Snoqualme Pass; as far as I went the valley was narrow and the descent steep. The Indians say that, at the distance of about twenty-five miles from the divide, the stream enters a lake, at the foot of which is a cascade some sixty feet in height. Lieutenant Hodges informs me that the officers of the Hudson's Bay Company at Nisqually are confident that the western portion of this pass is better than the corresponding portion of the Nahchess Pass. But the result of my short experience in this country has been, that not the slightest faith or confidence is to be placed in information derived from the employés of the company, or from the inhabitants of the Territory: in every instance when I have acted upon information thus obtained, I have been altogether deceived and misled. It will, therefore, be impossible to make any accurate comparison of the relative advantages of the west slopes of these passes until we have examined the whole of the Snoqualme Pass ourselves. Near St. Helens the mountains are by no means so large and rugged as near Mount Regnier, yet there does not appear to be so well marked and defined a pass. The lowest point over which our trail passed in that vicinity was 3,100 feet above Vancouver; yet, judging from the appearance of the country near St. Helens, I think there would be great difficulty in passing by the mountain. In the portion of the range near Regnier the mountains are so thickly timbered that it is very difficult to obtain any extensive view, and they are so rough as to make it exceedingly difficult to explore them even on foot. I have examined the divides on foot, and, from the short time at my disposal, have been unable to extend the examination as far as would be desirable.

Following the west slope of the mountains from Vancouver to the Cathlapoot'l river, the country is very densely timbered, and required constant cutting on the trail. With the exception of a few small tracts, the soil is poor. In the valley of the Cathlapoot'l, which we followed for four days, the country is quite rough and thickly timbered—the soil miserable, and no grass. On the east slopes, near Mount Adams, the country is generally covered by open pine woods, with a coarse grass, the soil not good enough to induce settlements. The last forty-five miles of the trail have been over barren sage plains, mostly without grass, always without timber, and very stony: in some of the valleys pretty good bunch-grass is found. The soil of the valleys of the Yakima and its branches, though very limited in extent, is good enough to make tolerable farms, if irrigated. The Indians raise excellent potatoes, but the cold nights (the thermometer frequently standing below 32° at sunrise) and the shortness of the season, would be great obstacles in the way of cultivation. We have found gold in this valley, but no deposit sufficiently rich to justify working. The Indians are thus far perfectly friendly. I have informed the chiefs of the probable passage of immigrants through their country, and of Governor Stevens's approach. They have promised to be friendly to the immigrants, and extend every assistance to them ; to prevent depredations on the part of their own people, and to refer any complaints they may have against the immigrants to the Governor on his arrival; but on no account to retaliate, as I have told them that would not for a moment be allowed.

I shall leave this place to-morrow for the north, and will endeavor to reach Fort Colville from Mount Baker.

While in the mountains myself, I sent one small party to the mouth of the Yakima and another to the Dalles. The Yakima valley below this is wide, often destitute of grass, no timber of any consequence, and a limited extent of soil that by irrigation could be made moderately productive. On the trail to the Dalles the country is everywhere stony, barren, and worthless. The valley of the Columbia, near the mouth of the Yakima, is a vast sage desert. I shall strike it again somewhat farther north. On the road to Steilacoom, after having passed the mountains, there are a few limited tracts of good land; that on the sound, and for some miles back, is a mere mass of gravel—perfectly worthless.

I am, sir, very respectfully, your obedient servant,

GEORGE B. McCLELLAN,
Lieut. Eng. and Brevet Capt. U. S. A., Commanding Expedition.

Hon. JEFFERSON DAVIS,
Secretary of War.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Benton, September 18, 1853.

SIR: Since my letters of the 8th instant, transmitted by Dr. Evans, the geologist of the expedition, very important changes have been made in the plan of continuing the survey westward, in consequence of the information brought by the arrival of Lieutenant Saxton.

I was on my way to the Piegan camps to secure guides for the survey of the Marias Pass, and to provide for permanent relations of peace with the Blackfeet, when Lieutenant Grover's express overtook me, sixty-five miles from this point, with information that he met Lieutenant Saxton just near the dividing ridge; that the road passed over by Lieutenant Saxton was in many places, in consequence of timber, impracticable for wagons, and that he would be at Fort Benton one day after the express, with much valuable information as to the routes west of the mountains. I immediately determined to return, sending forward Mr. Stanley, the artist of the expedition, with Hammel, the interpreter, and three voyageurs, to see the Indians and invite them to Fort Benton.

On my return, which was accomplished in less than twenty-five hours, I placed Mr. Lander's party in camp on the Marias river, where it would be in position either to move on to the exploration of the Marias, or join, by running a side line, the main party as it entered Cadotte's Pass.

Lieutenant Donelson having informed me, by the express bringing Lieutenant Grover's letter, that he should the next day move on with the whole party, in pursuance of my instructions, I despatched early in the morning our Indian guide, to direct him to move forward the advance party, that delay might not occur in the survey of the country, but to keep the supply train in camp till my arrival, and on my arrival to meet me with Lieutenant Saxton for consultation.

Reserving to a subsequent portion of this report some account of Lieutenant Saxton's admirable reconnaissance, one made under many difficulties, it will be sufficient for me to state that our mutual congratulations were of the most cordial character. He left Washington in April with instructions to organize a supply train on the Columbia, to establish a depot of animals and provisions at the St. Mary's village, and, passing over the Blackfeet trail, to meet me at Fort Benton.

It was in Washington determined to direct our first exploration on this pass. As we approached it from this side of the mountains, we called it Cadotte's Pass, from Cadotte, one of our guides, who passed over it two years since. My first thought, on reaching Fort Benton, was to send forward Lieutenant Grover to ascertain whether he had reached St. Mary's, or was on his way to this point. I point to the circumstance of their actual meeting within three miles of the dividing ridge, as some evidence of the goodness of the pass, and how well it was understood in the first instructions.

Cadotte's Pass is, by the barometer measurements of Lieutenant Saxton, nearly 3,000 feet below the South Pass, and is a much better route both in summer and in winter. It presents not the slightest difficulty to the passage of a railroad.

A copy of my Order No. 18, published on Lieutenant Saxton's arrival, shows the appreciation which we have of his labors.

I learned from Lieutenant Saxton that the passes in the Bitter Root and Cascade ranges were more difficult than those in the Rocky mountains; that they could not be crossed later than October, and that the greatest despatch must be used to reach the Pacific before the setting in of winter. I also learned that Captain McClellan was probably still struggling in the passes of the Cascade range, north of the Columbia, to ascertain the most practicable one, and that he could not be expected to push his line east of the Columbia the present season.

My previous arrangements had been based on the winter not setting in till the middle or last of November, and on having before me at least a working season of eight weeks. I found it to be reduced, at the very outside, to six, and as regards the Bitter Root range, where snows fall on the 20th, and sometimes as early as the 10th of October, to five weeks. The plateau between the Milk and the Missouri rivers rises gently, and is, in almost every direction, practicable for a railroad.

The St. Mary's valley connects with other valleys running both north and south at the base of the mountains, an aggregate distance of one hundred and fifty miles. Thus Cadotte's Pass connects all the railroad lines north of the Missouri with all the lines from the Columbia to Puget sound. Accordingly I determined to leave my wagons at this point, to resort entirely to packs to send my whole force through Cadotte's Pass with the greatest despatch, and direct them on several routes westward through the Bitter Root and Cascade ranges to ascertain the best pass, and to connect with Captain McClellan's work, and thus endeavor to collect the present season the data to establish the practicability of a railroad from the headwaters of the Mississippi to Puget sound.

The survey of the Marias Pass was deferred, and Mr. Lander, under orders for this service, was directed to report to Lieutenant Donelson, who was, by my orders of the 14th instant, a copy of which I herewith enclose, continued in charge of the main party operating in Cadotte's Pass. It was with great reluctance I abandoned the survey of the Marias Pass. I am sanguine that it will prove the best pass, and it more naturally connects with the line of Clark's fork of the Columbia river. The great obstacle to the survey of all these passes, and especially the Marias Pass, is in the immense forests which in all directions obstruct the way. The superabundance of nature has to be done away with in a measure before the full measure of her gifts can be known. The Indians pursue the best trails they can find; but they have not axes to hew their way, nor, finding one pass practicable, have they the patience to search for better ones.

To reach the valley of Clark's fork, a road from Cadotte's Pass must make a considerable deflection to the north, and it is believed that in no other direction can a road be run to the

Pacific, in consequence of the impracticable character of that portion of the Bitter Root ranges of mountain lying immediately west of the St. Mary's valley. Should, however, a good pass be found leading to the Little Salmon fork of Snake river, and should this route to the Pacific prove more feasible than more northern routes, then Cadotte's Pass will more naturally lead to it, and to the preferable one. Dr. Evans's survey shows that a railroad line can be run on nearly a straight course from the mouth of Milk river, between the Milk and Missouri, to the falls, and which, in connexion with a good pass in the Bitter Root range west of St. Mary's, would make the route by Cadotte's Pass, the Little Salmon, or Kooskooskia river, not only a remarkably direct route, but one that, by branches to Puget sound, to the Willamette valley of Oregon, and even to California, would afford great facilities to emigrants to both Territories, and be in connection with the great port of the Pacific. I shall give as much attention as practicable to the passes in this direction, though they are represented to me as entirely impracticable.

I have established at this place a meteorological and supply post, under the charge of Mr. Doty, with Corporal Kouster, of the dragoon detachment, to assist in charge of property; Private Lynt, of the sappers and miners, to assist in observations; and Hugh Robie, laborer and cook. Mr. Doty has rendered service on the route in the astronomical and magnetic observations, having been placed in charge of the latter observations a few days since. He is exceedingly well qualified for his duties, well educated, of decided character, of experience as a woodman, a hunter, and in intercourse with Indians. He will devote himself to the magnetic and meteorological observations, to getting in the topography to the base and into the passes of the mountains, and to maintaining the present friendly feelings of the Blackfeet Indians. A copy of his instructions is herewith enclosed.

From the post established at St. Mary's, as announced in my letter of the 8th instant, I expect the most valuable results, not only as illustrating the meteorology of the region west of the mountains, but in knowledge of the several passes by actual survey made before operations are resumed in the spring.

Lieutenant Saxton left New York on the 5th of May, and, taking the Isthmus route, arrived in San Francisco on the 1st of June. During the time he remained, delayed by procuring an outfit for his journey to the Flathead village, intelligent gentlemen pronounced his undertaking difficult, and indeed impracticable, from the hostility of the Indians, and the character of the country. He had intended to accomplish his labors with a small party of from four to six men. Not able to discourage him, they advised him to enlarge his force, and be attended with an escort. On the 27th of June he reached the Columbia barracks, and proceeded to organize his party and prepare his train. The most experienced and intelligent men there, including Governor P. S. Ogden, chief factor of the Hudson's Bay Company, discouraged his efforts, and predicted his entire failure of getting through this season in consequence of the bad country towards the mountains. Upon the urgent persuasion of these gentlemen, Lieutenant Saxton resolved, in carrying out his instructions, to take a larger party than originally contemplated.

On the 1st of July Lieutenant Saxton sent forward Lieutenant Arnold, 3d artillery, with the greater portion of the men and provisions to the Dalles, remaining at Columbia barracks to complete his arrangements. On the 18th of July the organization of this party was perfected, and he started for the mountains, his force consisting of Lieutenant Saxton, 4th artillery, in command; Lieutenant Richard Arnold, 3d artillery, astronomer; Mr. Lyman Arnold, his assistant; Lieutenant Macfeely and eighteen soldiers, of the 4th infantry, as an escort; Mr. D. S. Hoyt, assistant quartermaster's department; one packmaster, one assistant packmaster, twenty-three packers, and two herders.

Lieutenant Saxton encountered many obstacles on his march which were calculated to deter a man of less energy and force of character. The whole of one day he was crossing a sandy desert, the sand at a temperature of 150° Fahrenheit. On reaching the Pend d'Oreille lake, the supplies were all carried across in canoes, and, when over, they discovered that the prairie had been burnt for a great distance. The crossing of the burnt prairie and timber occupied four days, during which Lieutenant Saxton lost several of his horses, and every man advised his return. False reports as to the intention of the expedition had been circulated among the Indian tribes through whose country Lieutenant Saxton had to pass. They manifested much suspicion; but meeting Lieutenant Saxton, who had a talk with them, their doubts gradually vanished, and they became steadfast friends. He told them that we were their friends, that our objects were peaceable, and that among the highest of our duties was that of bearing the friendly messages of the Great Father at Washington to his children, and, attesting his kindly feelings by a few presents, he soon established friendly relations.

From this time to reaching the St. Mary's village, he found them ever willing to assist him. At each stream crossed, they were present with their canoes; and one instance occurred where, after assisting Lieutenant Saxton's party over, they sent on to him, requesting him to fix the rate they should hereafter receive for ferrying over other white men.

They reached the St. Mary's village on the 28th of August, after encountering such obstacles as are common to mountainous countries, obliged to cut their way through dense forests of mountain timber.

At this point Lieutenant Saxton placed his provisions in depot, leaving them in charge of Lieutenant Arnold and four men; sent Lieutenant Macfeely, with all the soldiers and quartermaster's employés whose services could be dispensed with, back to Vancouver, by another route; and, with Mr. Hoyt, his assistant, eight soldiers, eight packers, and an Indian guide, came across the Rocky mountains by the Blackfeet Pass, and joined me at Fort Benton. It is proper here to add, that much dread appeared to exist in regard to the Blackfeet Indians, and Lieutenant Saxton's guide, Antoine, an excellent man, would not come farther than the St. Mary's village unless the party numbered twenty men. It was his intention to bring but four men across the mountain to Fort Benton, but he was thus compelled to bring an escort.

Lieutenant Saxton followed up the Columbia as far as Wallah-Wallah; crossed Lewis fork of the Columbia forty miles from its junction with the latter stream; thence crossed the Spokane to Clark's fork; crossing Clark's fork near the outlet of Kalispel lake, continued along the northen shore of Lake Kalispel, and up the valley of Saint Mary's fork of the Bitter Root to the Flathead village.

Lieutenant Saxton reports the route he followed from the Dalles to this place as practicable for a railroad, the Rocky mountains offering no obstacle to its construction, and furnishing an almost inexhaustible supply of timber and other building materials. At the place where he crossed, the elevation is nearly three thousand feet less than the South Pass.

He found the country east of Kalispel lake deserted by the Indians, from fear of the Blackfeet. The universal opinion in regard to the viciousness and disposition to plunder of these Indians, keeps the whole country in terror during the summer season. The two Messrs. Owen, who for several years have been engaged in raising stock at the St. Mary's village, were met on their way to the Pacific coast, deeming it no longer safe to remain.

As good a map and barometric profile of the route as their rapid march and their limited means would allow, was made by Lieutenant Saxton's party.

I might add that the establishment of a depot at the St. Mary's village, with plenty of fat oxen, and the depot for which Lieutenant Saxton made especial provision at the head of Pend d'Oreille lake, where Governor P. S. Ogden has had collected an abundance of cattle for our supply, are facts the knowledge of which enables us to work much later, and secures us much from providing a great amount of transportation.

He has, in addition to the supply of provisions, left at St. Mary's sixty-three animals, which on our arrival will be in fine condition. My train moved forward with strong animals, fit for the service, after leaving at this post some nineteen feeble animals, which could not probably have stood the journey across the mountains, but should the survey be continued another year, will then be in good condition.

On the junction of Lieutenants Donelson and Mullan's parties with the party at St. Mary's, leaving at that post for the winter the animals unable to proceed, I shall have sufficient transportation to mount well every member of the survey, and with good packs be able to push forward, making forced marches of thirty-five and forty miles per day, if the season compels us to move so rapidly.

The unexpected arrival of Lieutenant Saxton with the information he has brought, changes, in several respects, my plans announced in letters written at this point on the 8th of September, and sent forward by Dr. Evans, who left on the 10th with packs for Oregon, and will connect with the mails to the Atlantic States some fortnight earlier than myself. I cannot do better at this time than enclose those copies, and make them part of this letter. I apprehend, however, that this will reach you before they possibly can.

In those letters I have briefly referred to our progress up to this point, and have frankly given a statement of the balance of the allotment of the appropriation for the survey intrusted to my charge. By the middle of October that will have been exhausted, and I have sent my estimates of what I regard actually necessary to continue the survey. I must refer you to Lieutenant Saxton in person for much valuable information in connexion with our work—its progress, and its certainty of success. I must earnestly recommend the appropriation, at an early date in the session, of one hundred and fifty thousand dollars, to continue all the surveys for the fiscal year ending June 30, 1854; and, should they make such appropriation, forty thousand as the allotment for this survey. The information brought by Lieutenant Saxton is of so important a character that I have thought it advisable to send him to Washington city to prepare his report, and communicate in person with the departments. He will be accompanied by Mr. D. S. Hoyt, his assistant in the quartermaster's department, and Sergeant Collins, of the detachment of sappers and miners, who will assist him in his office work.

I have concluded to send back from this point four non-commissioned officers and thirteen dragoons, whose services are no longer required, and they have been placed in charge of Lieutenant Saxton. Four discharged quartermaster's employés, who crossed the mountains with him, and three of my party who desired to be relieved from duty at this place, also go down the river to St. Louis. Sergeant Collins, who has been connected with the main party, has been unable to cross the mountains, in consequence of a severe attack of dysentery. Too much cannot be said in commendation of his merits since his connexion with the party. Lieutenant Donelson, in his report of the survey of the Missouri, notices his efficient service, and since his connexion with the main party as assistant topographer he has performed his duties admirably.

Of Mr. D. S. Hoyt, connected with Lieutenant Saxton as his assistant, I would merely say, that Lieutenant Saxton speaks of his labors as being in the highest degree satisfactory. He and Sergeant Collins are detailed for office duty with Lieutenant Saxton in assisting in the preparation of his report, and in resuming the survey next year. The following is a statement of the results already accomplished, those which will be gained during the remainder of the season and in the winter, and those which may be expected from the continuance of the survey, from the resumption of operations in the spring to the close of the next fiscal year.

RESULTS ALREADY ACCOMPLISHED.

1. A line drawn from the Dalles of the Columbia to the head of navigation of the Mississippi.

2. The ascertainment that Cadotte's Pass, in the Rocky mountains, is nearly 3,000 feet below the South Pass, and is a much better route, both in summer and in winter.

3. That this pass connects by the plateau between the Milk and Missouri rivers, rising gently to the mountains west from Fort Benton, and by the valley of the St. Mary's and other valleys, extending for 150 miles along the western base of the Rocky mountains, with the several known

practicable lines from the Mississippi river north of the Missouri, and with at least one practicable route to the Columbia.

4. That the routes north of the Missouri will connect with the Missouri at the mouth of the Yellowstone, and at the falls by easily constructed and short spur roads.

5. That the Missouri is navigable at all seasons, when not obstructed by ice, for some distance above Fort Union, and is believed to be navigable to the falls for steamers drawing 18 inches of water.

6. That east of the Yellowstone, all the roads must pass over the broad plateau of the Bois de Sioux and the valley of the Mouse river.

7. That roads may be run over the Bois de Sioux from several points on the Mississippi.

8. That at least two good routes can connect the Bois de Sioux with the Mouse River valley—one in the direction of Dead Colt Hillock, on the general route pursued by Lieutenant Grover, and one on the general route pursued by the main party crossing the Cheyenne river. These routes meet on the entrance into the Mouse River valley.

9. That the Milk river route affords extraordinary facilities for a railroad connecting with all the passes, and that a route can be pursued between the Milk and Missouri rivers, running near Fort Benton and the falls, and naturally connecting with Cadotte's Pass.

10. That a natural valley, called the Grand Coulée, connecting the routes between the mouth of the Yellowstone and the mountains with the Mouse River valley, and that the passage of the Coteau du Missouri is of easy grade.

11. That by a deflection from Cadotte's Pass along the valley of the St. Mary's river, a road can be made to Clark's fork of the Columbia, and by a somewhat circuitous route, and with expensive side cutting, can be extended to the head of navigation of the Columbia.

WORK TO BE DONE DURING THE FALL AND WINTER.

1. The route pursued by Lieutenant Saxton to be carefully examined by the estimating engineers, to collect the data for estimating the cost of the road. The profile to be tested by additional barometrical observations, and additional observations to be made for latitude and longitude. The line to be straightened and improved by side reconnaissance.

2. The survey of the Missouri to be continued to the falls, to determine its navigability for steamers, and the cost of removing the obstructions, to secure a greater depth of six to twelve inches.

3. A pass to be searched for in the Bitter Root range, and a route to be explored from Cadotte's Pass along the Little Salmon river to Wallah-Wallah, to connect with the survey already made by Captain McClellan, in laying out the military road from Wallah-Wallah to Nisqually.

4. A route to be examined from Cadotte's Pass by the Mission of St. Joseph, and passing over a somewhat difficult portion of the Bitter Root range, but much used by the Indians and half-breeds in passing from the mountains to Wallah-Wallah.

5. A detached party under Lieutenant Arnold to leave the main party operating on Lieutenant Saxton's line, and move to and beyond Fort Colville to the Cascade mountains, and thence along the eastern base to the line of the military road, to open a communication with Captain McClellan, and connect the surveys to the Columbia with the passes explored by him in that range.

6. Winter posts at Fort Benton and St. Mary's, under the charge of Mr. Doty and Lieutenant Mullan, to make meteorological and magnetic observations, surveys of the country along the base of the mountains, and into the entrance of the several passes, to collect information as to these passes from guides and Indians, in readiness for operations in the spring. In addition to which, attention to be given to collections and to the Indian tribes.

7. The survey of the mountain passes in winter by Lieutenant Grover, going with a dog train over all the ranges from Fort Benton to Puget sound.

8. Such observations as to the navigability of the Columbia as may be practicable at this late season.

9. Moving the main party to Puget sound over the pass found by Captain McClellan to be the best.

10. Meteorological posts at Wallah-Wallah, at Olympia, and possibly at Fort Colville.

11. Office work at Olympia, preparing the report.

WORK PROPOSED FROM THE RESUMPTION OF OPERATIONS IN THE SPRING TO THE CLOSE OF THE NEXT FISCAL YEAR.

1. Careful explorations of the Marias Pass of the Rocky mountains, and such other passes as from information acquired on the resumption of the survey shall come into competition with that at Cadotte's Pass.

2. The completion of the exploration of the Bitter Root and Cascade ranges, it being scarcely practicable to accomplish it the present season.

3. Instrumental surveys of the passes in all three ranges found by exploration to be the best.

4. These passes to be connected by reconnaissance in the best practicable manner.

5. The best pass in the Rocky mountains to be connected with the best crossing of the Mississippi, by a review of the whole line by a small party under the charge of a competent estimating civil engineer, regard being had to questions of supply and modes of construction; spur roads to the Missouri and a connexion with Lake Superior and the roads leading eastward from the Mississippi.

6. The careful survey of the Columbia river, to determine to what extent it can be made useful in transporting supplies, &c., for the construction of the road.

7. Examinations in relation to connecting the most practicable route with Oregon and California.

8. Re-continuance of the meteorological posts.

9. Information to be collected as to emigrant routes, wagon roads, and country adapted to settlement.

I append to this report copies of all the orders since leaving Camp Pierce, and copies of all the important instructions since leaving Fort Union. These papers will, in connexion with this communication, give as full a report of the present state of the exploration as my limited time will allow.

1. Copies of my three letters to the department of the 8th of September, forwarded by Dr. Evans, and which will not probably reach Washington till after this communication is received. They give a bird's-eye view of operations; state that the survey fund will probably be exhausted in October; state my determination to continue the survey, and organize a small but efficient winter force, in readiness to resume operations in the spring, and urge the recommending Congress to pass in the deficiency bill an appropriation of $40,000 to continue the work the remainder of the present fiscal year. They ask that the $10,000 now in the treasury, of the sum allotted from the appropriation to the survey of this route, and such other sums as may be applied to it from other appropriations, may be drawn from the treasury and be placed on deposit with the Treasurer, subject to my order. The only modification I now make of these views is, that I would recommend urging Congress to pass an appropriation of $150,000 to *continue all these great railroad explorations* during the remainder of the present fiscal year, and the same amount in the general appropriation bills for the next fiscal year.

2. Copy of my Order No. 18, (marked No. 4,) issued on the arrival of Lieutenant Saxton at Fort Benton.

3. Copy of my instructions to Lieutenant Grover, (marked No. 5,) directing him to reconnoitre Cadotte's Pass, ascertain whether Lieutenant Saxton had arrived at Fort Benton, and

directing him, on completing his mission, to return to Fort Benton, to complete the survey of the Missouri, and pass with a dog train over the mountains in the winter.

4. Copy of my instructions to Lieutenant Mullan, (marked No. 6,) directing him to repair to the Flathead camps, on the Muscle Shell river, and from that point to survey a route to St. Mary's through one of the passes leading from the forks of the Missouri.

5. Copies of three letters of instructions to Lieutenant Donelson, (marked 7, 8, and 9,) the two former based on continuing the exploration with wagons, and providing for the exploration of the Marias Pass by Mr. Lander, and the third changing the train from wagons to packs, and deferring to another season the exploration of the Marias Pass.

6. Copy of my instructions to Lieutenant Saxton, (marked No. 10,) directing him to take charge of the returned men, and to repair to Washington to prepare his report and give information to the department, &c.

7. Copy of my instructions to Mr. Doty, (marked No. 11,) placing him in charge of the meteorological and supply post at this point.

8. Copy of my General Order No. 11, (marked No. 12,) abandoning two lines of operations from Big Muddy river, and returning thanks to the men for their previous services.

9. All the remaining orders issued by myself or Lieutenant Donelson in connexion with the main party, viz: Orders No. 10, No. 12 to No. 17, and marked consecutively to 27.

10. Copy of camp regulations—(No. 28.)

11. Copy of my letter to Captain Gardiner, June 30, (No. 29,) relieving him from duty in consequence of ill health, and stating that I would assume the duties of quartermaster and commissary.

I am, sir, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

No. 4.

[ORDER No. 18.]

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Camp Dobbin, near Fort Benton, September 15, 1853.

The chief of the expedition congratulates Lieutenant Saxton and his party upon their safe arrival at Fort Benton, from the mouth of the Columbia. For indomitable energy, sound judgment, and the most crowning accomplishment, Lieutenant Saxton has the thanks of all his associates, and deserves honorable mention at the hands of all men who seek to advance the honor and renown of their country.

Lieutenant Grover, in command of the advance party to open a communication with the parties west of the mountains, and who met Lieutenant Saxton near the dividing ridge, also receives the thanks and congratulations of his associates in the great work now so ripe for success.

Daylight now breaks through the struggles of three months.

On the 8th of June the supply-train left Camp Pierce, on Lake Amelia, and on the 8th of September the parties from the Mississippi and the Pacific shook hands across the continent. The pass of the Rocky mountains is found to be more than one thousand feet below the South Pass, and is not only practicable, but expressly made to our hands for the great northern railroad.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Exploration.

No. 5.

FORT BENTON, UPPER MISSOURI,
September 5, 1853.

DEAR SIR: With a select party of seven men and sixteen animals, you are assigned to the duty of reconnoitring the Blackfoot trail to the St. Mary's village, and of the route from that point to the Kootenaies post. You will then return to this point and make the survey of the upper Missouri, from the Falls, to connect with Lieutenant Donelson's survey, which extended some distance above Fort Union. You will then return from Fort Union, and reconnoitre the country between the Milk and Missouri rivers. At Fort Benton you will get up a dog train and cross the mountains in the winter, make the best of your way to Puget sound, and report to me at Olympia.

In the reconnaissance to the St. Mary's village observe carefully camping grounds, the general practicability of the route for wagons, the particular difficulties, and how they are to be overcome. and send back by two of your voyageurs, H. Beaubien and Cadotte, a report in relation to the same—instructing them to deliver the report to myself or the officer in charge of the main train. Also give information as to whether a depôt has been established by Lieutenant Saxton at the Flathead village, and the provisions and animals in store there.

The object in going to the Kootenaies post is two-fold: First, to open the communication with Captain McClellan; and second, to open a connexion with the Hudson's Bay posts, in order to draw upon them for supplies for the prosecution of the survey west of the mountains, in the event Lieutenant Saxton has failed to establish a depôt at the St. Mary's village.

Upon your return I shall be able to give some general instructions in relation to the survey of the Missouri and the remaining work assigned to you.

It is important that I should meet Captain McClellan at the St. Mary's village, about the 25th of September. If practicable, get word to him to this effect.

Truly yours,

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Exploration.

Lieut. C. GROVER,
4th Artillery, U. S. Army, Fort Benton, Upper Missouri.

After the above letter was written—

NOTE.—Very full verbal instructions were given to Lieutenant Grover, that should he meet Lieutenant Saxton, either on the way or at St. Mary's, to return immediately and apprize me of such fact. In case Lieutenant Saxton had not established the depôt at St. Mary's, he was to push forward to the Kootenaies post, and from that point fit out, by the assistance of the Hudson's Bay Company, an express with a note to Captain McClellan, asking him, if practicable, to meet me on the 25th September, at the village of St. Mary's. After which Lieutenant Grover was to return at once to Fort Benton.

No. 6.

FORT BENTON, UPPER MISSOURI,
September 8, 1853.

DEAR SIR: With a select party, consisting of the Piegan guide, (the White Crane,) Mr. Rose, Mr. Burr, and two voyageurs, you will visit the Flathead camp, on the Muscle Shell river, about one hundred miles south of this place; and procuring the most intelligent and reliable Flathead guides, you will make your way to the St. Mary's village, exploring the best pass to that point from the headwaters of the Missouri river. You will collect every possible information as to routes, streams, prominent land-marks, and characteristic features of country;

noting particularly the general quality of the soil, the forest trees, grasses, quality of water, and practicability of the route for the passage of wagon trains. With the barometer you will make the best profile the time will allow of the route you pass over, and such facts as your limited means will allow, as to the feasibility of the route for a railroad.

But the great duty which I place in your hands, is to carry from me a message of the Great Father to the Flatheads. Assure them that the Great Father appreciates their services and understands their merits; that he will hereafter protect them from the incursions of the Blackfeet, and other Indians east of the mountains, and make them live as friends; that he will send to them, each year, certain articles which they most need; and that a faithful and intelligent agent shall live among them.

Speak of your own duties, and of your occupation of the St. Mary's post. I want to meet the prominent Flathead chiefs and braves at the St. Mary's village, at the close of the present month; and I rely on your energy and tact to induce them to accompany you to that point.

It is my determination to bring the tribes north of the Missouri, and those west of the mountains, into a general council at this point next year, and to make a lasting peace between all the tribes of Indians not included in previous arrangements. Dwell on this in the Flathead camp.

You understand well the general character of the Flatheads, the best Indians of the mountains or the plains. Honest, brave, docile, they need only encouragement to become good citizens. They are Christians; and we are assured by the good Father De Smet that they live up to the Christian code.

Dwell on the good Father, and say that his words in their favor have reached the Great Father and made all good men their friends.

I want to build up anew the village of St. Mary's. Let the Flatheads understand I am their friend—one who will join hands with former friends for their good. No labors will be more sweet than those which will enable me to place in permanent homes, in that beautiful valley, these interesting children of the mountains.

Truly yours,

ISAAC I. STEVENS,

Governor of Washington Territory, in Charge of Exploration.

Lieut. J. Mullan, Jr.,
1st Artillery, United States Army.

No. 7.

Fort Benton, *September* 7, 1853.

Dear Donelson: I am satisfied you should take the advance with the odometer party, a barometer, a sextant, two wagons, twenty to twenty-five men, and examine carefully the approaches to Cadotte's Pass. The country, and particularly the river crossings, the plateau east of the Teton to the Missouri, and from the same plateau to the plateau between the Sun river and the next considerable tributary of the Missouri, will especially require careful examination. On leaving the Sun river to reach the base of the first dividing ridge, several streams are crossed, and it is probable a wide range of country should be taken. It is probable you will be obliged to halt every alternate day in order to do the side work. The detached parties for this work should not exceed three men. Two will often be sufficient.

The whole train will reach you by the time you are at the base of the first dividing ridge, and then the advanced party must be turned into a pioneer party to remove obstructions. Whatever reports are sent to me, I am now determined to push a wagon train through; nor shall a mule be packed, except for side work, till we reach the point where we are compelled to unload our wagons.

It is impossible to give more definite instructions than those indicated in my letter of day before yesterday, and given in this note. Much is left, of necessity, to the judgment of the officers charged with the work. It involves a constant exercise of judgment and a careful study of every new fact. The country is not known except in a general way; but enough is known to say that the approaches to Cadotte's Pass must be over a large space of country, and the examinations must be such that the main features shall be given with accuracy.

When Mr. Tinkham gets in, he can at once join you, giving to the region you pass over in advance a careful examination for facts and general views of construction. With his work, and that of Mr. Lander and Lieut. Grover, the connexion from Milk River valley with your work will be complete.

I wish you to throw yourself into this work with your whole force. It is important that not a day should be lost.

As regards Lieutenant Mullan, unless his services are indispensable, he should go to the Flathead camp, reaching St. Mary's village by a new and more southern pass. The force placed at his disposal must of necessity be small. Including one Indian (Piegan) and Mr. Rose, (Mr. Culbertson's storekeeper) I cannot assign more than two men. Yet it must be certain that he can be spared from the magnetic observations and from the main train. He will, at all events, find his field on reaching the St. Mary's village.

You must go in advance, and if possible to-morrow. The main train should move not longer than four days after you. It will consist of twelve mule wagons, not loaded more than 1,200 pounds each.

I shall push all my business through to-day, and have not the time to consult I desire. When you come in, and come early, have your programme complete for the advance party, and I will decide at once.

* * * * * * * * * * *

[Here follow some unimportant paragraphs, relating to duty for next day, &c.]

Truly yours,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

No. 8.

FORT BENTON, UPPER MISSOURI,
September 7, 1853.

SIR: You are placed in charge of the survey of the railroad route from this point through Cadotte's Pass to the St. Mary's village, and your force will consist of the odometer party, in charge of Mr. Lambert, assisted by Sergeant Collins; the astronomical party, in charge of Mr. Stevens, assisted by Sapper Roach; the magnetic party, in charge of Mr. Doty, assisted by Sapper Wilson; Dr. Suckley, the surgeon and naturalist of the expedition, assisted by Sapper Horner; the meteorological party, in charge of Mr. Moffett, assisted by Mr. Burr and the trained sappers of your detachment; Mr. Tinkham, estimating engineer; Mr. Osgood, the disbursing quartermaster and commissary agent and acting quartermaster and commissary of the party, and especially in charge of the baggage and supply train, with Sergeant Higgins, Corporals Coster, Simpson, and Pierson, assistant wagon and pack-masters; Sergeant Lindner in command of dragoons, Corporal Causser with the mountain howitzer, and fourteen non-commissioned officers and men of the dragoon detachment; Mr. French and Mr. Morgan, artificers; Bashall, the blacksmith, Meckleback, saddler, and twenty-seven quartermaster's employés, &c.

You will form an advance party, consisting of the odometer party, the estimating engineer, (as soon as he shall have returned from his reconnaissance of the Three Buttes,) and Mr. Adams, assistant artist; an assistant from the meteorological party, a small detachment of dragoons, with the necessary employés of the quartermaster's department, two wagons, rations for fifteen days, will move forward at once towards Cadotte's Pass, moving slowly, covering the ground with great care from the dividing ridge east of the Big Teton to the Missouri river, and including a rapid reconnaissance of the falls of the Missouri river.

The approaches to Cadotte's Pass must be examined with care, and full information gained as to river crossings and side approaches. The space to be covered, at first large, will undoubtedly narrow towards the entrance to the pass. Advantage must be taken of hills to gain views of country. Small detached parties of one, two, or at most three men, must be thrown out for purposes of reconnaissance. In the pass the lateral valleys and passes should be examined to the extent of the force at your disposal. More definite instructions cannot be given. The field will open and the right methods will be suggested as you advance. Much must be left, of necessity, to your own judgment. I refer you, in relation to this matter, to my letter of this morning, which will be considered as a portion of these instructions, and in which my views are given as to the method of conducting operations.

For information as to the details of the work, I refer you to my printed instructions, to the written instructions addressed to and in possession of the chiefs of parties, and to the methods actually in use since your connexion with the main party.

The supply and baggage train will move forward on the 11th or 12th instant, in charge of Mr. Osgood, and the marches will be so arranged between the two portions of the command, as that the whole shall be brought together at the foot of the first dividing ridge, and where the greatest obstructions to the passage of wagons are said to be found. All the baggage will be carried in wagons, and the train will consist of twelve mule teams and one ox-wagon.

On reaching the point where serious difficulties may occur to the passage of wagons, an efficient pioneer party should be organized, kept well ahead to remove obstructions, and prepare for the passage of the train. Ample supplies of rope and tackle should be provided. You are instructed to direct your energies to the passage of the train, though not to involve serious detriment to the prosecution of the survey. All the pack-saddles will be taken along to provide for the possible necessity of abandoning the wagons. The wagons will not, however, be abandoned without my direct order, and you are authorized, when, in your judgment, the task of pushing through the wagon train shall endanger the operations of the survey, to make a report in writing to me to that effect, and to turn over the train to Mr. Osgood, taking the rations necessary for reaching the St. Mary's village, and leaving to me the responsibility of deciding upon the question of continuing the effort to get the train to the St. Mary's. In drawing rations, however, you will leave with the train at least double the amount taken for the party you may organize under your immediate charge for the survey. I cannot authorize, however, the separation of the party, and placing the entire responsibility of the train with Mr. Osgood, without your written report, referred to above, addressed to me, and placed in his hands. That report will authorize Mr. Osgood to take such measures for the care of the train and animals as, in his judgment, may be necessary.

On reaching the St. Mary's village, you will rest your animals and await my arrival—conforming, however, to instructions you may receive from Captain McClellan. It is probable that Lieutenant Mullan may reach that point not long after your arrival, bringing excellent Flathead guides, acquainted with the several passes to the Hudson's Bay posts on the Columbia river, and to Fort Hall. No time should be lost in gaining every possible information as to routes. In case of a depot not having been established at the St. Mary's village by Lieutenant Saxton, Dr. Evans, the geologist of the expedition, has instructions to bring up supplies from the Dalles for the service of the parties that may operate from the St. Mary's village.

It is my intention to establish at the St. Mary's village a winter post in charge of Lieutenant Mullan, to operate in the passes of the mountains till driven out by snow, and then to explore the lateral valleys and passes. Its establishment is essential to secure success to the contemplated survey, by Lieutenant Grover, of Cadotte's Pass, with a dog train, in the month of January.

Lieutenant Grover has already preceded you to reconnoitre the pass, and to open a communication with Captain McClellan. On reaching Medicine river, you may expect to meet his express, consisting of Cadotte and H. Beaubien, with a letter to me, giving information as to camps, water, difficulties of the route, and as to the arrival of Lieutenant Saxton at St. Mary's. This you will open and copy, and will then send the express forward with it to the supply train, and thence to meet me.

Should Lieutenant Grover meet you on his return, before you reach St. Mary's, you will furnish him with such men as he may select for his winter's work, not exceeding eight in his whole party, and render such assistance as he may require on his way to Fort Benton.

The most vigilant attention must be given to issues of provisions, and only half rations of hard bread and flour will be allowed when fresh meat is in abundance. This rule will apply to the gentlemen as well as men of the party. Single rations of sugar and coffee only can be allowed, except on extraordinary occasions.

I need not enlarge upon the necessity of care of animals, and keeping daily reports, as it is already well understood by you, and has been made the occasion of issuing an excellent order.

The scientific parties left behind will all move with the supply train. It is my expectation to return from the Piegan camp about the 18th instant; to move from Fort Benton not later than the 20th, and to reach the St. Mary's valley by the close of the month.

Yours, &c.,

ISAAC I. STEVENS,

Governor of Washington Territory, in Command of Exploration.

Lieutenant A. J. Donelson,

Corps of Engineers.

No. 9.

Northern Pacific Railroad Exploration and Survey,

Camp Dobbin, near Fort Benton, September 14, 1853.

Dear Sir: The arrival of Lieutenant Saxton, with information of the establishment of the St. Mary's post, of the practicability of Cadotte's Pass, and of the route pursued by him for a railroad, but with the information that the Bitter Root range of mountains cannot with certainty be crossed after the 20th of October, makes it necessary to use all possible despatch in crossing the Rocky range, and getting the exploring parties at work on their general routes westward to the Columbia.

The survey of the Marias Pass will be deferred until next year. Mr. Lander's party, assigned to this duty, have been directed to report to you. The whole party will move through the pass under your direction, with pack-train. Two efficient parties, under the associate engineers, Messrs. Lander and Tinkham, will get in side-work, and make the necessary estimates. Mr. Graham will report to you for astronomical duty, and Mr. Bixby to Mr. Lambert, in charge of the odometer party, for running the base-line. All the dragoons, except Sergeant Lindner, Corporals Coster and Rummell, will be ordered to report to Lieutenant Saxton. Mr. Doty will be directed to report to me with Corporal Coster, and will occupy Fort Benton as a meteorological and supply post. An observer may be kept at Fort Union. The two Osbornes, the blacksmith and saddler, will also report to Lieutenant Saxton.

Mr. Stevens will report to me with the portable transit, and the necessary astronomical instruments, for special duty. When your train is in readiness to move, all the stores and baggage left behind will be turned over to Mr. Osgood, who will report to me for his duties, in connexion with all the parties, as the disbursing, quartermaster, and commissary agent of the expedition.

You will press on, carrying out my instructions of the 8th instant, with all your vigor, and reach Saint Mary's at the earliest practicable moment. If I do not arrive within three days, organize your parties to explore, and survey routes to the Columbia, directing more especially towards and beyond Fort Colville, to meet Captain McClellan, and establish the Saint Mary's post under Lieutenant Mullan, with a force of ten to twenty, consisting of the seven soldiers of the 4th infantry, and such employés and voyageurs of the original party, operating from the Mississippi, as may consent to remain with their present pay, and of an experienced meteorologist, and, if practicable, a good topographer. Lieutenant Mullan has had verbal instructions from me as to his duties, and you will, on conference with him, have all the information to enable you to give the necessary written instructions.

I shall endeavor to leave this place in six days, and hope to reach St. Mary's within three days after your arrival.

Yours, truly,
ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Lieutenant A. J. DONELSON,
Corps of Engineers.

No. 10.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Benton, September 19, 1853.

DEAR SIR: You are instructed to take charge of the enlisted men who have reported to you to be returned from this point, and, with the keel-boat which has been purchased on account of the quartermaster's department, proceed down the Missouri with the greatest possible despatch, in execution of the following duties:

First. To return the enlisted men to their appropriate army service, either at Fort Leavenworth or at St. Louis, as may be deemed by you the more advisable; and in like manner to discharge and pay off the employés of the quartermaster's department—affording, however, to all who may desire it, transportation to St. Louis.

Second. To turn over the keel-boat for the service of the quartermaster's department at Fort Leavenworth, or dispose of the same by sale, as the public interest may require.

Third. To proceed to Washington, organize your office force, which will consist of your assistant in the quartermaster's department, Mr. Hoyt and Sergeant Collins, of the detachment of sappers and miners. This report you are requested to prepare with great care, and to send it at the earliest possible period to me at Olympia; at the same time you will send a copy of it in my name to the Secretary of War.

It is suggested that in this report you give in separate chapters the results of your observations in botany, natural history, and geology, and you are requested not only to report, in great detail, your experience with the Indians, but to enter fully into the several questions of Indian policy, especially those relating to their being reclaimed from a wandering life to permanent homes.

Fourth. Sergeant Collins, of the detachment of sappers and miners, is assigned to duty as an assistant in the work, and on resuming the survey; and you are authorized to continue Mr. Hoyt in the service of the expedition for the same purpose.

Fifth. One of your most important duties in Washington will be to afford information to the departments and to Congress as to this hitherto unexplored region of country, and to show how the interests and the honor of the country require the continuance of three great geographical explorations.

Sixth. You have had opportunities to observe the Indian tribes, and your experience, in connexion with that gained by our parties moving westward from the Mississippi, has established in all our minds the conviction that a council should be held next year at this point, to enter into a treaty with all the Indians north of the Missouri not included in existing arrangements, and those immediately west of the mountains, providing that hereafter they should cease warring upon each other, and continue, for all time to come, the friends of the whites. The time is ripe for such a consummation. I desire you to devote your energies to call the attention of the department and of Congress to this subject. In a letter which I shall send by you to the Commissioner of the Indian Bureau, I shall urge that Congress be asked to appropriate money early in the session to defray the expenses of this council, and that a steamer, applicable to the service generally of the Indian bureau on the Missouri, be chartered or purchased to reach this point.

Seventh. It is hoped that appropriations will also be made early in the session to continue the survey, in which case you are requested to make the best practicable arrangements to reach this point with the assistants, Mr. Hoyt and Sergeant Collins, now on duty with you, for the purpose of exploring the region west. If appropriations be made early in the session for continuing the survey and for holding a council, it is believed that the best interests of the two services would make it absolutely necessary to secure a steamer to insure efficiency to each. To that end, much is expected from your experience and judgment.

Eighth. On reaching Puget sound, and ascertaining the condition of the work at the close of the season, I shall send more full instructions in relation to the place of continuing the survey and the supplies, instruments, and assistance required to be brought to this point. One thing is certain: a letter from Washington addressing me that appropriations have been made, and that a steamer will be placed upon the river, will give me notice two weeks before it will be necessary to leave Olympia for Fort Benton to meet it.

Ninth. Going down the Missouri, you will be able to collect many valuable facts in reference to its general character, as to the steamer adapted to navigate it, as to depôts for wood and the best method of supplying them, and as to the probable time required to make the trip, both up and down the river, which will add much to the value of your report.

Tenth. I shall, at the earliest practicable moment, submit a report on the navigability of the Missouri, based on the surveys of Lieutenants Donelson and Grover, and your own observations; but should not this report be received before you have to act, I will express the opinion that you can reach Fort Benton by the middle of June, leaving St. Louis early in May, with a steamer drawing eighteen inches of water.

Eleventh. A. Culbertson, special agent among the Blackfeet Indians, goes with you, under instructions from me to repair to Washington as soon as his other arrangements will permit, to urge the importance of entering, without delay, into treaty arrangements with these Indians and those west of the mountains. His experience of twenty years among these Indians, and his known force of character, will give great weight to his views. I expect that there will be the most cordial co-operation between you in relation to these Indian questions. He knows thoroughly the river, and will put his hand to the helm.

Twelfth. William Graham and Henry Beaubien, who have at this point, at their request, been relieved from their connexion with the expedition, will accompany you, and be furnished with transportation and subsistence to St. Louis.

Yours, &c.,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Lieut. Rufus Saxton,
4th Artillery, Fort Benton.

No. 11.

Instructions to James Doty, left in command of the meteorological and supply post of the Northern Pacific Railroad Exploration and Survey established at Fort Benton, September, 1853.

SIR: You are placed in command of the meteorological and supply post at Fort Benton. Corporal Coster, Sapper Lynt, and Hugh Robie, are placed under your command: Coster to assist in taking care of the property left at this post, Lynt to assist in observations, Robie as cook and laborer.

Observations will be made with the barometers, thermometers, and hygrometer, three times each day. The amount of rain will be determined by the river gauge. It is desirable to ascertain the general character of the winter: as, the depth and continuance of snow; time at which the river is frozen; time of breaking up; floating ice; freshets, &c.

It is important that all opportunities for observations of the Indian tribes in this vicinity should be improved. Information is desired concerning their habits, customs and tradition; the boundaries of their country; their wintering places, and their hunting-grounds in summer. It is supposed that these Indians are often found upon the California emigrant trail, and even as far south as Taos, in New Mexico. Ascertain, if possible, whether their predatory excursions have this range.

Topographical explorations may be made when practicable.

The winter trading posts of the American Fur Company may be visited whenever the company's employés go there to trade during the winter, at which time much valuable information may be acquired concerning the Indians and the general features of their country.

It is desirable to make collections in natural history, mineralogy and botany, and to keep a full journal of all of interest that transpires.

You will remain in charge of this post until the 1st of July next, or until relieved by orders from myself. I shall make every exertion to reach Fort Benton, *via* Puget sound, in June next.

I leave with you the printed instructions and a copy of the letter of the Commissioner of the Indian Bureau, authorizing me to enter into negotiations with all Indians north of the Missouri, not included in existing arrangements.

Very truly and respectfully,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

MR. DOTY.

No. 12.

[ORDER No. 11.]

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Camp Atchison, Mouth of Milk River, August 19, 1853.

The plan of continuing the survey to Fort Benton in two parties, determined upon at Fort Union and announced in a letter to the Secretary of War, dated August 8, 1853, under the respective directions of Lieutenants Donelson and Grover, having been abandoned at the junction of the two camps on the west side of Big Muddy river, the following arrangements are made, adapted to the plan now in execution of moving in one line by Milk river:

1. Lieutenant Donelson is the executive officer of the expedition. Under the direction of the chief of the expedition, he will exercise a general supervision on the march, and in camp regulate the details of guards, supervise the inspection of arms, and see generally that the orders of the chief of the expedition are executed. He will take general charge of all the observations, connecting them with the odometer survey, the work of the reconnoitring officers and that of the civil engineers, and will make a daily report in relation to this connexion, its character, scope, and completeness, and will, as the assistant of the chief of the

expedition in charge of the observations, submit such other reports, and give, in his name, such directions as may be required. Corporal Cunningham and Artificer Smith, of the engineer detachment, are especially assigned to duty with Lieutenant Donelson.

2. Lieutenants Grover and Mullan are placed in charge of the magnetic observations, and Mr. Stevens is relieved therefrom. Daily observations of declination, dips, and intensity, should be made whenever practicable. These observations, in importance and interest, are secondary to none in the expedition, and from the joint labors of Lieutenants Grover and Mullan the best results are expected. Private Roach, of the engineer detachment, is assigned to duty with these observations, as an aid. This opportunity must be availed of to acknowledge the services of Mr. Stevens in this department.

3. Lieutenant Grover is also requested to make such astronomical observations as his time and circumstances will admit of, in order to be ready to take charge personally of all observations on detached service, to which he at any moment may be assigned. Much is expected from his known energy, activity, and ability in all departments of the expedition. He is directed to do such reconnoitring as may be compatible with his other duties, and, by examination of guides and Indians, and particularly by a free interchange of views with the civil engineers, gain every possible information in reference to probable routes—reporting daily to the chief of the expedition in relation thereto.

4. Mr. Stevens is continued on duty as the astronomer of the expedition. Great attention must be given to these observations, particularly those of lunar distances, and with the portable transit. This instrument should be mounted as often as practicable, and it is believed that on reaching Fort Benton, the longitude of that point, and the rates of the chronometers can by it be determined with great accuracy.

Messrs. Doty and Graham are continued on duty in the astronomical department as assistants, and thanks are returned to them for the efficient aid they have already rendered. Mr. West is especially commended for his great patience and fidelity in the performance of his duty, and, with Private Wilson, of the engineer detachment, is also continued on duty as an aid.

5. The meteorological observations are continued in charge of Mr. Moffett, with Mr. Burr as an assistant, and Artificers Davis and Lynt, and Private Broadwell, of the engineer detachment, as aids. Mr. Moffet's industry, perseverance, and success in overcoming many practical difficulties, and in faithfully making and recording a large number of observations, are acknowledged. In addition to faithfully assisting in the camp observations, Mr. Burr has, on detached duty, shown a high spirit, and rendered efficient service.

6. The civil engineer party is placed on the following basis: Mr. Lander, with Mr. Evelyn as assistant, is charged with the duty of taking large views of country, with collecting information in reference to supplies, the location of the road, and questions of transportation, and, in connexion with data afforded by the odometer survey, and by detached parties, estimates and reports upon the general construction and location of the road. In these duties Mr. Tinkham will be associated with Mr. Lander.

Mr. Lambert is placed in charge of the odometer survey, with Sergeant Collins, of the engineer detachment, as assistant topographer, and Mr. Bixby to run the compass line. The civil engineers and the topographer will make daily reports to the chief of the expedition.

7. The artist and naturalist of the expedition will act under the immediate instructions of the chief of the expedition, who may, however, communicate instructions through the senior officer, Lieutenant Donelson. The same remarks will apply to the quartermaster and commissary agent of the expedition, Mr. Osgood, who will also, in relation to camps and marches, act under the immediate direction of the executive officer. Mr. Kendall is continued on duty, with Mr. Osgood as general assistant, and Corporal Coster, of the dragoon detachment, in the details of quartermaster and commissary duties. Mr. Adams, whose services as assistant topographer from the Mississippi to Fort Union, both on the line of the odometer survey and on reconnaissance, have been of great value, is assigned to the artist as an assistant. Private

Horner, of the engineer detachment, is continued on duty with the naturalist, as an aid. The services he has rendered are entitled to notice.

8. All matters petaining to Indians will be referred, in all cases where practicable, to the chief of the expedition; and all persons are enjoined to carry out the mild, humane, but firm policy, as instructed by those having charge of our Indian affairs. To this end reasonable issues of provisions will be made, and, under regulation, free access to camp will be permitted. But all men are enjoined to be on their guard, and the general deportment of the camp should be vigilant to prevent stampede of animals and the loss of single men.

The interpreters employed must be used in intercourse with the Indians, to guard against misunderstanding, and that their real wants may be known. In the absence of the chief of the expedition, reference must be had to Mr. Culbertson, special agent among the Blackfeet Indians.

9. The chief of the expedition cannot omit this opportunity to acknowledge the great services of Lieutenants Donelson and Grover: the former for his elaborate survey of the Missouri river to above Fort Union, and his reconnaissance of the country in the vicinity of Fort Union, from the White Earth to the Big Muddy rivers. The survey of the Missouri, prosecuted under great difficulties, was not only very complete, affording even the data for prosecuting operations to make it more navigable, but was enriched with large collections in geology and natural history, and illustrated by characteristic views. The reconnaissance from the White Earth to the Big Muddy was necessary to complete the work of the overland parties. In this work the services of Lieutenant Mullan and Mr. Graham have largely contributed, and their services deserve special commendation. The services of Sergeant Collins, of the engineer detachment, particularly in the topographical survey of the Missouri river, deserve notice; they not only reflect credit on the company to which he belongs, but bespeak for him a career of future usefulness.

Lieutenant Grover, deflecting from the course of the main party at an early stage in its march, and taking charge of a small detached party at a period when such service was considered one of peril, steadily contended with and overcame all obstacles and difficulties, and, with the eye of an engineer marking out his course, reached Fort Union seven days before the main party. The chief of the expedition would do injustice to his appreciation of Lieutenant Grover's services if he failed to express his admiration and respect for them. In this connexion is noticed the valuable aid afforded to Lieutenant Grover by Mr. Evelyn, in charge of the train, and Corporal Cunningham, of the sappers and miners, in charge of the odometer and compass on that line. Their services are deserving of warm commendation.

The services of Lieutenant Mullan in relation to the survey of the Missouri, and the reconnaissance from the White Earth to the Big Muddy rivers, have been of the most marked character, and entitle him to especial commendation. Particularly has he brought up the meteorological observations to a proper standard, and taken charge of the collections. His services in training assistants have been most valuable.

Mr. Graham, who had charge of the astronomical observations under direction of Lieutenant Donelson, deserves especial notice for his efficient services, rendered amidst many trying difficulties. Acknowledgments are due to the civil engineers, Messrs. Lander and Tinkham: Mr. Lander, for his examination and report on the crossing of the Mississippi, his reconnaissance of the Cheyenne valley, of the Dog's House, and of the Mouse river and the Coteau du Missouri, and for the consummate judgment and great experience which he has brought to his department of the work; and Mr. Tinkham, for the admirable compass line, connecting the geographical positions, which he has run half across the continent, and for valuable topographical and statistical information collected on the route. Mr. Bixby, in charge of the compass, did not even seem conscious of difficulties or obstructions in his course.

The expedition has been most fortunate in its surgeon and naturalist, Dr. Suckley. Not only a scholar and gentleman, beloved by all, but eminent for his genius, his energy, his diligence, whose efforts have been felt in all departments of the expedition.

The artist, Mr. Stanley, has illustrated, in the most faithful manner, all that has been done and seen. The topographer, Mr. Lambert, has shown his extraordinary talent in his department of the work, and to great professional excellence has added untiring application.

The most emphatic acknowledgments are due to Mr. Stevens, the astronomer of the expedition, for his perseverance amidst many practical difficulties, and for his cheerful performance of duty when overtasked with work, and overloaded with the duties of a new and difficult department not contemplated to be assigned to his charge, and for the valuable results which he has contributed to the expedition.

The sound judgment, steady course, and great integrity of the disbursing quartermaster and commissary agent, Mr. Osgood, have not only done much towards overcoming many difficulties in the expedition, and to establishing kindly relations between its several parts, but have commanded the respect and won the affection of both the officers and men. Mr. Everett, the quarmaster and commissary clerk, a veteran in the public service, has been to all an example of constancy and diligence. Mr. Kendall's services in difficult confidential business at the early stage of the expedition, in connexion with instruments and supplies, and, at a later period, in charge of the feeble animals, and preparing them for a return to service, were in the highest degree of advantage to the expedition, and are gratefully acknowledged.

Mr. Evans, the assistant of the chief of the expedition in the custody and preparation of papers, orders, &c., has cheerfully performed his varied duties, and has in all departments rendered efficient service.

The sappers and miners on duty with the expedition have, by their labors, added to its results, and will, before its close, identify themselves and their arm with every one of the scientific departments, and with the collections and surveys.

Thanks have already been returned to the guides and hunters, the detachment of dragoons, and the several employés of the quartermaster's department; but the present occasion is availed of to repeat the grateful acknowledgments of services, and to say, that with such men all obstacles will surely be overcome in the accomplishment of the great objects of the expedition.

In closing this order, the efficiency of Sergeant Lindner, (of the dragoon detachment,) of Sergeant Higgins, (the wagonmaster,) and of Sergeant Simpson, (the pack-master,) on duty with the main party, and of Corporal Coster and Mr. Pierson with Lieutenant Grover's party, is especially commended.

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

No. 13.

[ORDER No. 1.]

CAMP PIERCE, *May* 30, 1853.

Lieutenant Grover having requested to be relieved from the duties of acting assistant quartermaster and commissary of the expedition for the survey and exploration of a railroad from the Mississippi to Puget sound, in order to devote his time to the performance of the scientific duties of the expedition, and Captain Gardiner having consented to act in that capacity, Lieutenant Grover is relieved from that duty, and Captain Gardiner will, from this date, act as quartermaster and commissary.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 14.

[ORDER No. 2.]

CAMP PIERCE, *May* 30, 1853.

The astronomical and magnetic observations are intrusted to the charge of George W. Stevens, Esq., and Captain A. Remenyi, who will alternate daily in taking charge of each class of observations. Mr. Stevens will at first take charge of the astronomical, whilst Captain Remenyi will have care of the magnetic, and thereafter alternate each day. Both will assist in these branches of labor, and freely confer with and consult each other.

Mr. B. F. Kendall, who is expected to arrive shortly, and one sapper, will be assigned to Mr. Stevens, and one sapper and Mr. Yekelfoleusy will assist Captain Remenyi.

Messrs. Stevens and Remenyi are expected to instruct their respective assistants in the astronomical and magnetic observations, the use of instruments, and each to make a daily report in writing, while in camp, of their observations and labors, particularly stating the progress each man makes under their instructions, with the view to ascertain the character of the duties which such assistants are best adapted to perform.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 15.

[ORDER No. 3.]

CAMP PIERCE, *May* 31, 1853.

Mr. Tinkham, with his civil engineers, will move off at 12 o'clock, with one common wagon, (to be replaced hereafter by a spring-wagon,) and the second mule team brought up on the Shenandoah, four well broken riding-mules, one good teamster, provisions for fifteen days, forage for five days, one wall and one common tent, two Colt's revolvers, two Sharp's and two ordinary rifles, with the necessary ammunition.

Captain Gardiner will have Mr. Tinkham fitted out as above, so that he may move promptly at 12 o'clock.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 16.

[ORDER No. 4.]

CAMP PIERCE, *May* 31, 1853.

If practicable, six wagons, with stores not needed till the main body reaches the crossing of the Mississippi, above Sauk rapids, will move early to-morrow morning, in charge of a suitable person to be designated by Captain Gardiner, should the weather be propitious; it will be well to load the wagons, and do something towards breaking in the animals to-day.

Instructions have been given to Mr. Lander to make arrangements for the crossing of the Mississippi, and the wagonmaster will, if practicable, move his animals across the river, and place them in a good camping ground to await the arrival of the main body.

Suitable arms and ammunition will be issued to the train, and good care must be taken of the stores.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 17.

[ORDER No. 5.]

CAMP PIERCE, *June* 5, 1853.

Arrangements will be made to move camp on Monday morning, and every exertion will be made to reach Sauk rapids on Friday, and cross the river on Saturday.

The officers and gentlemen of the scientific corps will take the boat at the Falls on Monday, which will enable them to reach Sauk rapids on Tuesday evening; one wagon, and the riding-mule of each person of the party, will accompany them.

An astronomical and magnetic station will be established west of the Sauk rapids.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 18.

[ORDER No. 6.]

CAMP DAVIS, *near Sauk Rapids.*

There will be an inspection of camp at 10 o'clock this morning. This will include an inspection of personal baggage and camp equipage, and property of all descriptions.

The officers of scientific corps, the dragoon detachment, and the quartermasters, will be drawn up.

Lieutenant Du Barry will make the necessary arrangements, and give the proper notifications.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 19.

[ORDER No. 7.]

CAMP DAVIS, *June* 13, 1853.

For purposes of convenience in detailing guards, and to give a military organization to the entire expedition, the following gentlemen are appointed to the grade of lieutenant: Isaac T. Osgood, J. M. Stanley, A. W. Tinkham, F. W. Lander, A. Remenyi, G. W. Stevens, John Lambert.

The following assimilated to the grade of non-commissioned officers: Joseph F. Moffett, James Doty, James Evelyn, James Gear, B. F. Kendall, Thomas Adams, M. Strobel, Yekelfoleusy, Simpson, Higgins, E. Evans.

The remainder will be detailed with artificers, and privates of sappers and miners, and privates of dragoons.

The medical (Dr. Suckley's) position is assimilated to that of an assistant surgeon in the army, and dates from the period of his joining the expedition.

The parties organized under the several chiefs will, on coming together, preserve their distinctive organization; the chief of the expedition—in his absence the senior officer present—regulating the general mode of encampment, police, and supervising the details of guard. The principle of the foregoing encampment must be complied with.

It is considered of great consequence that the several trains should not be intermingled; and the dragoons attached to the several parties will continue with them, camping and working with them, receiving their orders only from their particular chiefs, even when the whole force is brought together.

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

No. 20.

[ORDER No. 8.]

CAMP NEAR LIGHTNING LAKE,
July 19, 1853.

The most rigid economy in the consumption of provisions being necessary, the caterer of each mess will carefully note, in a book kept for the purpose, the daily amount consumed of the various articles constituting the ration, which book shall be daily inspected by the chief of each party.

Whilst in the game country the quantity of pork and bacon must be diminished. Where the supply of game and fish is sufficient to furnish as much as each man can eat, the quantity of pork and bacon should be reduced to the minimum—one-eighth of a pound a day.

Caterers of messes are enjoined also to note the amount of game, fish, &c., furnished to their respective messes.

When parties come together, the hunters and guides will report to the chief of the expedition, or, in his absence, to the senior officer. The reason for this is obvious: they are employed to benefit the whole expedition, and this course will insure the best result in procuring and securing an equitable distribution of supplies.

It is made the duty of the senior officer to see that the game is equitably distributed, as between the parties, and of the chief of each party between the several messes.

No. 21.

[ORDER No. 9.]

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
9° *N. W. Fort Union Camp, August* 16, 1853.

The most careful attention to animals is enjoined upon all persons engaged in the expedition, and will be rigidly enforced. The animals must not go beyond a walk, except in case of necessity; and each mounted man must walk some four or five miles each day to rest his animal, unless it be impracticable, in consequence of his duties. At halts, men must dismount. This direction will be enforced, as well in regard to private as to public animals.

I. I. STEVENS,
Governor of Washington Territory, in Command of Expedition.

[ORDER No. 10.]

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Camp Atchison, Mouth of Milk River, August 19, 1853.

In addition to the regular nightly guard, there will, commencing with to-day, be hereafter detailed one non-commissioned officer and four sentinels, who shall constitute a day guard, and whose duties shall be regulated as follows:

1. The detail shall be made from a roster, consisting of all persons who now go on guard as non-commissioned officers, who shall be detailed, in turn, as non-commissioned officers of this day guard, and of all persons who are now subject to detail as sentinels, who shall be detailed, in turn, as sentinels of the day guard; except that the chief wagonmasters, the persons in charge of the horses and of the pack-train, the carpenters and blacksmiths, and the cooks, shall be excused from this duty.

2. The tour of the day guard shall commence when the sentinels of the night guard are taken off post in the morning, and shall terminate when those sentinels go on post in the evening. They shall be divided into reliefs, and regularly posted, prior to leaving camp in the morning, and after encamping in the afternoon, as well as at halts made during the day.

3. The officer of the guard on any night shall have charge of the guard of the subsequent

day, and shall enforce the orders in reference thereto. The two guards should otherwise be kept separate and distinct. The day guard should be so arranged that it shall include no person who may be on the night guard; and the day tour ought, if possible, to be intermediate between two of his night tours.

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

No. 22.

[ORDER No. 12.]

NORTHERN PACIFIC RAILROAD SURVEY,
Camp Atchison, Mouth of Milk River, August 20, 1853.

On the march the train will keep as much together as possible; the speed of the wagons will be regulated by Governor Stevens's ambulance or wagon, or by the instrument wagon. The acting quartermaster will regulate the pace of the leading team in such a manner that all other teams can keep up without forcing the mules. No person except guides, or those having permission, will precede the train by more than one-fourth of a mile, or go farther from it than that distance, unless in case of necessity, or for the performance of some duty.

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

No. 23.

[ORDER No. 13.]

CAMP No. —, MILK RIVER,
September 1, 1853.

The undersigned, on the part of the government, of the chief of the expedition, and for himself, as being directly responsible, returns thanks to the members of this party for the *energy* and *promptitude* they displayed in taking precautionary measures against the prairie fires on the night of the 30th and morning of the 31st of August.

A. J. DONELSON,
Lieutenant Engineers, Executive Officer.

No. 24.

[ORDER No. 14.]

CAMP No. —, MILK RIVER,
September 1, 1853.

I. No animal should go beyond a walk, except in case of necessity. No man should leave the line without permission of the officer in charge.

II. The mules and horses, after being watered, are to be picketed within the line of tents and wagons, at the first bugle-call after coming into camp; oxen to be hobbled at the same time. Daily reports of animals to be rendered to the quartermaster, according to the following programme: 1. Report to be rendered immediately after the animals are picketed in the evening. 2. The report to state the number and condition of the animals, and whether they have been properly picketed. 3. Mr. Higgins to report concerning all the animals at present under his charge, including that ridden by the cook of the teamster's mess; Mr. French, concerning all loose horses, those ridden by persons of his party, those ridden by the hunters, and that of the cook of his mess; Mr. Pearson to report concerning all mules, horses, and oxen belonging to the cart train; Sergeant Collins and Sergeant Lindner, concerning all mules and horses ridden respectively by sappers and dragoons; Mr. Simpson to report upon all loose mules, all mules ridden by persons of his party, including that of the cook of his mess and those driven in the carts. The other reports to be rendered by messes, the chief of each to report concerning the horses and mules ridden by persons of the mess, including cooks and attendants, and excepting any which are to be accounted for by other persons. 4. The persons in charge, or who render the above reports, are also held responsible for a compliance, both in camp and on the march, with all the orders in reference to animals. 5. The quartermaster will, in the evening, after receiving the above reports, state in general terms their substance to the senior officer present.

III. Extra issues of flour are not to be made, except in reference to the chief of the expedition, or, in his absence, to the senior officer present.

IV. No changes will be made in the employment of persons, or in the use of animals which come under the charge of the quartermaster, except by his permission, and he will report any such changes to the senior officer as soon after they are made as practicable. The quartermaster will also report to the senior officer prior to the abandonment of any portion of the train, or in cases of a similar nature which may arise. No changes will be made in the employment of persons, or in the use of the animals not under the direction of the quartermaster, except by permission of the senior officer present.

V. While in camp, no person will fire within one hundred yards of the line of wagons and tents. No person will fire while on the march without special permission of the senior officer present. All persons are required to keep within at least a quarter of a mile of the wagon train, except those who belong to the cart train, which is generally separate, unless they leave for the performance of some duty, or by special permission. This requires that all persons should halt when the train does, and leave camp, and halt, at the same time with it.

VI. Every one riding, or having charge of horses and mules, is required to take every precaution for preserving them in good order and condition, dismounting at halt, taking the bits from the animals' mouths when occasion offers for grazing, and resting them by walking some portion of every day's march. So much of the order now in existence as requires the walking to take place immediately after the noon halt is, for the present, suspended.

On account of the danger of losing animals by Indians, the greatest vigilance is required on the part of guard and sentinels, and the greatest care on the part of those who have charge of picketing the mules and horses.

VII. The foregoing—partly new orders, partly orders already in existence—are here published in order that every one may know what is required of him, and what restrictions are adopted for the safety and good order of the train while in camp and on the march.

A. J. DONELSON,
Lieutenant Engineers, Senior Officer.

ENDORSEMENTS ON THE ABOVE.

This order, which is no more nor less than a salutary and reasonable restriction, imposed for the general good on every person of the command, must hereafter be obeyed. As a matter of course, the senior officer present with the train is responsible for the orderly march thereof. Every person having the command, assimilated or otherwise, of a body of men, is responsible that they obey orders, and all persons who are not under the command or charge of any second person, are directly accountable for a compliance with existing orders to the senior officer actually present with the train.

A. J. DONELSON,
Lieutenant Engineers, Senior Officer.

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CAMP No. 59, *September* 3, 1853.

The within orders not having been carried by the orderly to all the persons concerned, they are now sent around again. Attention is called to the paragraph in reference to firing on the march. While no objection exists to hunting or shooting game where those wishing to do so are, by permission or on duty, away from the line, it is manifestly injurious to the service that the march of a line of 80 men and 192 animals should be exposed to accident or delay by persons firing indiscriminately at game which may come near the train, particularly when there are hunters whose duty it is to kill and bring in fresh meat.

No. 25.

[ORDER No. 15.]

CAMP No. 60, *September* 5, 1853.

To-morrow morning, before starting, and after the mules are hitched to the wagons, all the horses and mules which are ridden, as well as all loose horses and mules, will be arranged in a line for being inspected. The team mules and oxen will be inspected while they are harnessed up. The cooks will be awakened at daybreak; the animals will be turned loose to graze at the same time; breakfast will be at 5½ o'clock, tents struck and teams harnessed at six.

A. J. DONELSON,
Lieutenant Engineers, Executive Officer.

No. 26.

[ORDER No. 16.]

CAMP DOBBIN, NEAR FORT BENTON,
September 9, 1853.

In obedience to the assignment of the chief of the expedition, as expressed in instructions dated the 7th instant, and received this day, the undersigned hereby assumes charge of the party for the survey of the railroad route from this point, through Cadotte's Pass, to the St. Mary's village, as designated in said instructions, or in others of a similar nature. This party consists of the following persons, viz:

Lieutenant A. J. Donelson, in charge; Dr. George Suckley, surgeon and naturalist; Mr. A. W. Tinkham, estimating engineer; Mr. G. W. Stevens, astronomer; Mr. John Lambert, in charge of odometer survey; Mr. Joseph F. Moffett, meteorologist, &c.; Mr. James Doty, assistant astronomer; Mr. Thomas Adams, assistant artist; Mr. B. F. Kendall, assistant to quartermaster; Mr. P. Higgins, wagonmaster; Mr. James Simpson, pack-master and in charge of loose mules; Mr. Henry Pierson, assistant wagonmaster; Mr. French, in charge of loose horses; Mr. West, carrying chronometers; Sergeant Collins, sapper, assistant in odometer survey; Artisan Davis, sapper, assistant to meteorologist; Artisan Lynt, sapper, assistant to meteorologist; Artisan Smith, sapper, second assistant on odometer survey; Private Broadwell, sapper, assistant to meteorologist; Private Horner, sapper, assistant to Dr. Suckley; Private Roche, sapper, assistant to Mr. Stevens; Private Wilson, sapper, assistant to Mr. Doty; Sergeant Lindner, dragoon, commissary sergeant and assistant guide; Corporal Roaster, dragoon, assistant commissary sergeant and assistant guide; Corporal Coster, dragoon, in charge of howitzer; Corporal Lake, dragoon, in command of rear guard; Corporal Chowning, dragoon, in charge of pitching and striking tents; Private Magruder, dragoon, on detail for tents; Privates Ashcroft, Dittman, Otes, Hoggins, Smith, Donavan, Goerkey, Gauss, Flinn, Magahran, and Maxfield; Teamsters McGee and Wilson, Lieutenant Donelson's team; Teamsters McGinnis, Bell, and Monroe, Mr. Osgood's team; Teamsters Gear and Agnew, instrument wagon; Teamsters Davis, Bracken, Saint Louis, Dume, Winn, and Mitchelle; Saddler, Michelback; Blacksmith, Bashall;

Pelissier and Camartin, in charge of loose mules; Benoit, Duprey, Corri, Seeley, Nye, Farnham, Simpson, jr., Dauphin, William, Hudson, Osborne 1st, Osborne 2d, George Smith, Hugh Robie, and Baptiste; Indian Yellow Hair, guide.

A. J. DONELSON,
Lieutenant Engineers, in Command.

No. 27.

[ORDER No. 17.]

CAMP DOBBIN, *September* 11, 1853.

The quartermaster having reported that the repairs and other arrangements which were required would be completed this day, the scientific parties and the train will start for the Flathead village as early as possible to-morrow morning. Attention is called to the orders which exist in reference to duties in camp and on the march. These must hereafter be obeyed. Persons in charge are held responsible for those who compose their parties; thus the quartermaster is responsible for all employed in that department, Mr. Higgins for the teamsters, Mr. Simpson for the packers, &c. The principal of the orders are herewith sent around by the orderly to the chiefs of parties, and their contents will by them be communicated to those under their charge.

The portion of the command which has been designated as an advance, will, for reasons growing out of the approach of Lieutenant Saxton and return of Lieutenant Grover, for the present accompany the main train.

A. J. DONELSON,
Lieutenant Engineers, in Command.

No. 28.

CAMP REGULATIONS.

1. There is no such thing as an escort to this expedition. Each man is escorted by every other man. The chiefs of the scientific corps will equally with the officers of the army act as officers of the guard. The aids will assist in this duty equally with the non-commissioned officers of the sappers and miners, and of the dragoon detachment. The quartermaster employés will stand guard equally with the privates, and sappers and miners, and dragoons. It is confidently believed, that every member of the expedition will cheerfully do his duty in promoting all the objects of the expedition, sharing its toils of every description.

2. Each man of the expedition will habitually go armed. The chief of each party and detachment will rigidly inspect arms each morning and evening. Except in extraordinary cases, there shall be no march on Sunday. On that day there will be a thorough inspection of persons and things. Clothes should be washed and mended, and, if water can be found, each man will be required to bathe his whole person. This course is taken to secure health.

3. The Indian country will be reached in ten days. There is no danger to be apprehended, except from the want of vigilance of guards, and the carelessness of single men. The chief of a party or detachment will inspect the guard from time to time in the night, and report every case of inattention to duty.

4. It will be the habitual rule of each member of the scientific corps to take charge of his own horse, and to take from and place in the wagon his own personal baggage. As private servants are not allowed, the necessity of this rule will be apparent. There are exceptional cases, however, as the chief of a party, or where great labor has to be performed.

5. There will be no firing of any description, either in camp or on the march, except by the

hunters and guides, and certain members of the scientific corps, without permission of the chief of the expedition, or, in case of detachments, of the officer in charge of the detachment.

No. 29.

CAMP PIERCE, *June* 3, 1853.

DEAR SIR: It is with great regret that I learn from your letter of this date, enclosing the certificate of Dr. Suckley, the medical officer of the expedition, that in consequence of your health you are obliged to ask to be relieved from duty with the expedition under my command.

I have looked forward to your co-operation as a great element in the success of the expedition, bringing as it would the very experience to the work in which the other officers associated with us and myself are deficient. But I see no alternative, observing as I have done the state of your health, with your application, and the certificate of Dr. Suckley before me, than promptly to comply with your request.

You may be sure I shall never forget the lively interest you have taken in the success of the expedition, the exertion you have made to forward it, and your efficient assistance in making the preparations for the field. You are accordingly relieved from the duty with the command, and are directed to repair to Washington city and report for duty.

[Unimportant paragraph omitted.]

I will personally discharge the duties of quartermaster and commissary of the expedition, and will sign the necessary papers whenever they shall be prepared.

Truly your friend,

ISAAC I. STEVENS,

Governor of Washington Territory, in Command of Expedition.

Capt. J. W. T. GARDINER,

First Dragoons, U. S. Army.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,

Olympia, W. T., December 5, 1853,

SIR: I have the honor to report my arrival at this place, and to submit the following statement of operations since my report from Fort Benton. Before entering upon the narrative, it will be proper for me to state that I feel the greatest satisfaction at the complete success of the exploration, and that the report will show an amount of work reflecting the highest credit upon my associates. No disaster or untoward circumstance has marred the work. The parties have reached the Columbia river in the highest spirits—no man broken down by over-exertion or unnecessary exposure. The three great western ranges have been crossed in the fall; no snow whatever seen, except on the topmost peaks till the last days of October, and then only for a few inches, passing away in two or three days. I can pronounce, with the greatest confidence, the route to be eminently practicable; and in so doing, I feel repaid for the great exertions I have made, and the great anxiety which at times has almost overcome me, in preparing for and conducting the exploration. I am confident that when our contributions in the way of general geography, and in the development of the resources and character of the country passed over, are given to the public, it will be conceded that a public advantage has accrued far outweighing the expenditure, even should other railroad routes be finally determined on. Moreover, the exploration has been a vital element in the management of the Indian tribes, restraining their predatory habits, and disposing them to rely upon the general government to guaranty to them peace and protect them in their rights.

In the narrative of operations which I shall now present, the several letters of instructions will be referred to, and copies of the same given in an appendix; and such results will be stated as can be relied on, previous to a careful analysis and comparison of all the data in the office.

In my report from Fort Benton, my reasons were given for pushing all the parties through Cadotte's Pass, and for abandoning the examination of the Marias.

Previous, however, to this conclusion, Lieutenant Mullan had set out from Fort Benton to visit the Flathead camp on the Muscle Shell river, and thence to explore a more southern route to the St. Mary's valley.

Lieutenant Donelson moved from his camp on the Teton river, September 16, and pressed forward vigorously to his work, with two efficient civil engineer parties under Messrs. Lander and Tinkham for side reconnaissance and the general estimate, and an odometer party under that most able topographer, Mr. Lambert. I remained at Fort Benton till Mr. Stanley returned, on the 20th September, with a large delegation of the Blackfeet Indians, when a most amicable and satisfactory council was held with them on the next day, at which they agreed to respect all whites travelling through their country, to cease sending their war parties against the neighboring tribes, and to submit to the Great Father the settlement of their difficulties. One of their principal chiefs, Low Hone, in a speech of great eloquence and power, implored his people, now for the first time they had experienced the protecting care of the Great Father, to listen to his words; and he commanded them to abide by the promises just made in council. He desired me to say to all the Indians west of the mountains that the Blackfeet were no longer their enemies, and that they desired to meet them in council at Fort Benton next year. This I deem a measure essential to establishing a general peace, and have, in a communication to the Commissioner of Indian Affairs, earnestly recommended it.

This business brought to so satisfactory a conclusion on the 21st September, I set out early on the 22d with a select party, consisting of Mr. Stanley, the artist, Mr. Osgood, the disbursing agent, and Dr. Suckley, our surgeon, who, leaving Lieutenant Donelson's command to visit the falls, was not able to rejoin it, and returned to Fort Benton. Messrs. Evans and Kendall, two young gentlemen, kept behind to assist me in my correspondence, and five voyageurs and an Indian guide; and camping with Lieutenant Donelson at the end of the fourth day, I reached the St. Mary's village at noon on the 28th instant, making a distance of about two hundred and forty-three miles in six and a half days. Lieutenant Donelson reached the village on the 29th instant, and Lieutenant Mullan on the 30th. In Lieutenant Donelson's exploration of the route from Fort Benton to the St. Mary's village, Mr. Lander was very successful in approaching the mountains high up at the Marias river, and towards the sources of the Teton, Medicine, and Dearborn rivers, and entered the mountains, finding in each case excellent railroad crossings, and crossed the dividing ridge some miles north of the pass pursued by both Lieutenants Donelson and Saxton, bringing with him an excellent railroad line to the junction of the two routes in the main pass. As regards both entrances to the pass, a small tunnel will be required in each case—not, however, exceeding one mile in length; and the grades approaching the passes will not probably exceed forty or forty-five feet per mile. The descent down the Hell Gate river was mostly through an open valley, till the Hell Gate passage is reached, where the river winds in a narrow defile, requiring for a railroad expensive sustaining walls and embankments, and probably some small tunnels to avoid short curves.

It is practicable, though expensive, for a railroad.

It can be turned, however, two ways: 1st, by tunnelling a marble mountain south of it on the route of Lieutenant Saxton, and in relation to which I shall soon receive a report; and, 2d, by crossing over from a tributary of the Hell Gate in the open valley of the pass to the valley of the river Jocko, one of the principal southern tributaries of Clark's fork. Mr. Tinkham was assigned by Lieutenant Donelson to this duty, and with his detached party left the main party on the 26th September, with instructions to reach Fort Benton in six days. Reserving to a future paragraph a notice of this important side route of Mr. Tinkham, I will notice Lieutenant Mullan's route; simply stating that the two routes come together at the Hell Gate passage, and that the St. Mary's valley affords an excellent railroad line, not only to the St. Mary's village, but high up towards its source.

Lieutenant Mullan, as the department has already been advised, left Fort Benton on the 9th instant, and struck the Muscle Shell river on the 13th. After following the trail of the Flathead camp eastward twenty miles to a pond, and thence twenty miles farther in a southeastern direction, over a rough and difficult country, he found it still five days ahead of him, and determined to place his party in camp, and with his Indian guide follow on the trail. The Flathead camp was found sixty or seventy miles distant, in a beautiful valley, and he was received with the greatest hospitality. Four of the principal chiefs agreed to accompany him to the St. Mary's village. His route was by the north fork of the Muscle Shell, thence by an excellent prairie road to Smith's river, which flows into the Missouri in a northeasterly direction, and which he followed for a considerable distance; when finding it to lead too far to the north, he left it and crossed to the Missouri over an easy divide, and struck it at a point where a most excellent road led westward some twenty miles to the dividing ridge, whence rises the main fork of the Bitter Root river. This dividing ridge he crossed the second day after leaving the Missouri, the divide being only four hundred feet high and three miles across, and proving the only difficult point of passage in his route from Fort Benton. Thence his route was by the Blackfoot fork of the St. Mary's river, and the St. Mary's river to Fort Owen. The valleys open the whole distance, except in the case of a single mountain shutting down upon the river bank, and making a light side cutting necessary to a good wagon road, and the grades scarcely perceptible either for rails or wagons the whole distance.

Immediately on reaching the St. Mary's village, Lieutenant Arnold, in charge of the post left there by Lieutenant Saxton, sent for Victor, the Flathead chief, (the small remnant of the tribe not on the hunt east of the mountains, and in camp some forty miles down the river,) for a conference in reference to the condition of the tribe, its disposition towards meeting the Blackfeet in council, and to communicate the determination of the government to protect them in their rights. A portion of the camp moved up to the village and met the chiefs who accompanied Lieutenant Mullan. Victor, however, was absent on business to the Cœur d'Alene mission, and I did not meet him for some days. The conference was satisfactory, and impressed me very favorably as regards the truthfulness and worth of these Indians. The spirit of my conference, as well as that of Lieutenant Mullan, will appear from my instructions to him at Fort Benton, which have already been communicated to the department, and his report, a copy of which I herewith enclose. I will particularly call your attention to his account of the fertile valleys of the Muscle Shell and Smith's rivers, to the mild climate west of the Missouri, and the rich and abundant grass on the whole route. The same luxuriance of the grasses is everywhere found in the valleys of the Rocky mountains and the adjacent prairies.

On my arrival at Fort Owen, the importance of establishing the winter post already determined upon was only the more apparent, and fifteen men were placed on duty with Lieutenant Mullan. Unfortunately but few of the animals left by Lieutenant Saxton were fit for service, and were all needed for the parties going westward over the Cœur d'Alene mountains.

The remaining animals were, however, gradually improving, and would, it was believed, furnish Lieutenant Mullan in the course of ten weeks the means of running a line down to Fort Hall to connect our surveys with those of Frémont. By referring to a copy of his instructions, herewith enclosed and marked 2, it will be seen that he has likewise had assigned to him the duty of extending the survey northward, of making all possible examination of the passes, and to occupy a meteorological post during the winter. Very good specimens of gold have been found in the St. Mary's valley, and Lieutenant Mullan's attention has been specially called to it in these instructions.

Lieutenant Donelson was placed in command of the principal party with the civil engineer Mr. Lander, and Lieutenant Arnold associated with Mr. Stevens in the astronomical observations, and also in charge of a separate party for side reconnaissance. It was now important to give such directions to the operations as to insure a connection between the eastern and western divisions of the survey; and whilst Lieutenant Donelson was moving along the general line of Clark's fork, I determined with a little party, consisting of Mr. Stanley, Mr. Osgood, and four men, to push over the Cœur d'Alene mountains by the Cœur d'Alene mission, and thence to proceed to Colville to bring about a connection. To guard against Captain McClellan passing us, Lieutenant Donelson was instructed to send Lieutenant Arnold to Colville from the crossing of Clark's fork by the northern trail, and to repair to the Spokane house, on the Spokane river, to receive additional instructions. He was directed in his instructions to Lieutenant Arnold to provide for his not meeting Captain McClellan or receiving instructions from me, and was likewise directed, in case of a similar experience on his own part, to push forward on his own route, either by Wallah-Wallah or the valley of the Yakima, and thence over the military road to Nisqually, taking the precaution, however, to communicate in any event with Wallah-Wallah for instructions.

I likewise determined to assign that resolute and intelligent civil engineer, Mr. Tinkham, to the duty of examining the Marias Pass, of returning by the main Flathead trail to St. Mary's, thence by the southern Nez Perces trail to Wallah-Wallah, and thence on the military road to Nisqually and Olympia.

To bring about a thorough understanding as to the mutual relations of the work intrusted to Lieutenant Mullan and Mr. Doty, on the two sides of the Rocky mountains, it seemed to me important that Mr. Doty should accompany Mr. Tinkham to St. Mary's to confer with Lieutenant Mullan, and then to return by a known trail to Fort Benton.

This general plan being determined upon, the necessary verbal instructions were given to Lieutenants Donelson and Mullan on their arrival. Under Lieutenant Donelson's instructions, Mr. Lander was assigned to the duty of exploring the whole of the St. Mary's valley, and of meeting the main party in the Horse Plain, nearly opposite the confluence of the two streams. But a serious embarrassment now occurred in consequence of the non-arrival of Mr. Tinkham. Fortunately, all the parties had a common route down the valley for some thirty odd miles to opposite Hell Gate. On the 2d instant they were all in motion, with an extra supply of provisions for Mr. Tinkham's party, in charge of three men of Lieutenant Mullan's command, and proceeded in slow marches down the valley. We were in camp opposite Hell Gate on the 5th instant, and I then determined the next day to push forward Lieutenant Donelson and remain in camp till Mr. Tinkham's party returned, or some decisive steps could be taken to recover it. It was obvious to my mind that Mr. Tinkham had got involved in a difficult, perhaps impracticable country, as he took no guide with him, and my great fear was that he might suffer for want of food. Accordingly, that evening I despatched a Flathead guide to Fort Owen, with instructions to Lieutenant Mullan to come to my camp with additional provisions and men; and in a conference with Victor, who had now returned from the mission, secured the services of good Flathead guides. Lieutenant Donelson and Mr. Lander moved off on the sixth; but scarcely had Lieutenant Mullan reached my camp, about four in the afternoon, before Mr. Tinkham came in. The provisions had held out, and the route examined by him had an important bearing on our railroad question. In the absence of Lieutenant Donelson's written report, and the barometric profile, I can only say that it will probably furnish a practicable mode of avoiding the Hell Gate defile, and of passing from the valley of the pass to that of Clark's fork. The trail not being much in use, was difficult to follow, and the party frequently became entangled in boggy ground and dense thickets.

They finally struck into a valley passing between impracticable mountains, and so crowded with wood that their route had to be cut. They proceeded down the valley to near Clark's fork, and then succeeded in crossing over to the valley of the Jocko river, where a much-used trail led to the St. Mary's valley. In his course Mr. Tinkham passed by a winter post of the Hudson's Bay Company, and fell in with a small party of Indians.

The same evening Mr. Tinkham made his arrangements to reach Lieutenant Donelson's camp the next day, and exchange his tired animals for fresh ones. He started on his duty with the greatest alacrity, and will, I am confident, do most thoroughly the work intrusted to his charge.

I omitted to mention in the proper place that Dr. Suckley was directed to remain at the valley with a small party of the men to complete his specimens in natural history, and then to go down the St. Mary's, Clark's fork, and Columbia river, in a boat, continuing the collection of the animals, and making the best survey his limited means would allow. For my additional instructions to Lieutenant Donelson, Dr. Suckley, Mr. Tinkham, and Mr. Doty, and for additional instructions to Lieutenant Grover, see appendices 3, 4, 5, 6, and 7.

On the 7th my little party was in motion, and on the 12th I reached the Cœur d'Alene mission. The route on the mountain was much obstructed by fallen timber, and at times passed through dense underbrush. Mr. Stanley made a most excellent survey of the route; but the want of instruments rendered it impossible to get the barometric profile. Two streams having their sources in lakes only half a mile apart, flow due east and west in opposite directions from the route. The ascent is along the stream to within about five miles of the dividing ridge, when the trail rises two thousand feet, by estimation, in that distance, and thence passing along the ridge of a spur for a considerable distance, falls suddenly at least two thousand five hundred feet. Its course thence to the mission is generally along the river called by the Jesuit fathers St. Ignatius, but known more generally as the Cœur d'Alene.

We camped within one mile of the top of the mountain on the nights of the 10th and 11th November in a rain-storm, and looked forward to snow in the morning; but, to our agreeable surprise, we awoke to the clearest skies and the most genial breezes we ever experienced. Not a cloud was to be seen. The vast solitude of the Cœur d'Alene mountains covered with heavy forest trees, the Rocky mountains in the far east, and the Kootenaies mountains to the north in British territory, formed a *coup d'œil* imposing and magnificent. The slow and lazily rising belts and lines of fog indicated the position of the lakes and streams. A year ago, at this very time, the blasts of winter howled in these solitudes, and the drifting and rapidly falling snow completely obstructed the traveller.

Whether this route will come into competition with that by Clark's fork can only be determined by more accurate observation than we were able to make. It is probable that by following up on either side the stream itself, the length of the tunnel could be reduced to six and perhaps four miles without involving impracticable grades: it will considerably abridge the distance; but the difficulties from snow should be carefully investigated. The route was good in grass even on the mountain tops, except for some miles in the valley of the Cœur d'Alene. It is a favorite route of the Spokanes and Nez Perces on their way to the buffalo hunt.

At the Cœur d'Alene mission I got no information as to Captain McClellan; but from a Cayuse Indian who reached the mission the day my people rested there, I learned of the arrival of a party from the mountains, which I supposed to be Lieutenant Macfeely's, and of thirty-five emigrant wagons having started on the new military road to Steilacoom.

On the 15th of October I left the Cœur d'Alene mission, where I was most hospitably entertained by the Father Gazzile, and proceeded down the Cœur d'Alene river on my way to Colville. Various rumors reached me as to parties moving through the country, but nothing of a definite shape till about noon on the 18th of that month, when within fifty miles of Colville an old Spokane, only four days from the Yakima country, joined me, and gave me information that a party of some thirty men had reached the Columbia opposite to Colville the day before, and would cross that day. This satisfied me that by pushing to Colville that night I would join Captain McClellan before he moved to the eastward, and thus at once combine all the operations. Securing two good, fresh, fat Indian horses and an Indian guide, I started at two o'clock, and succeeded in reaching Colville at nine, and in a few moments the information in all its parts was completely verified, and Captain McClellan and myself were congratulating each other upon our most fortunate meeting. Not a word had we heard of each other since the

9th May, when he received my instructions, and when, in conversation, Colville was referred to as a probable point where he would first get information of the eastern parties. We reached Colville the same day, the 18th October.

You have already received a communication from Captain McClellan stating the principal facts in regard to the Nahchess and Snoqualme Passes, and his action in regard to the military road. Reserving to a future communication a more full report of his work, I will state that he found the country erroneously laid down on the maps, and that the country north of the Snoqualme Pass is very rugged, the mountains in many cases extending to the Columbia river. Very little information of the country was obtained from the Indians as Captain McClellan went north; but all the streams were examined towards their sources till the ascent became several hundred feet per mile, and the ground thoroughly explored to above the 49th parallel. Good railroad crossings of the Columbia river have been found above the mouth of the Yakima. I apprehend no difficulty whatever in the Snoqualme Pass to the passage of a railroad; and from information I have received from old residents here, particularly from Major Goldsborough, a civil engineer who has examined carefully the country, it will be an easy matter to carry it to a good harbor on the sound.

Through Garry, the Spokane chief, a man of education, of strict probity, and great influence over his tribe, I sent Indian runners to Lieutenant Donelson, appointing a little valley south of the Spokane river, near the junction of the routes from Colville and Lieutenant Donelson's place of crossing Clark's fork to Wallah-Wallah, as the place for bringing together both divisions; designing, if the state of the animals and the condition of the instruments would authorize it, to continue, under the direction of Captain McClellan, the odometer survey over the Cascades to Puget sound, and submitting that portion of the route to the inspection and estimate of Mr. Lander, one of the civil engineers. It was also designed to send a small party across the Columbia a little above the mouth of the Snake river, and follow the north bank of the Columbia to the Dalles and Vancouver. The remainder of the party were to proceed to Wallah-Wallah and the Dalles, and then receive instructions as to the discharge of men and the arrangement for office-work.

The juncture was effected on the 28th October, Captain McClellan and myself reaching the camp, which I named Camp Washington, only the day before Lieutenant Donelson; and the greatest joy was in every heart at the unlooked for and extraordinary good fortune which had attended every step of the exploration.

The meeting of parties from the Mississippi and the Pacific in the passes of the mountains and in the valleys of the interior, on the great railroad routes, each in the vigorous examination of his part of the work, and to within a single day; the peaceful relations which had been established with all the Indian tribes, the health, good conduct, and harmony of action of all the men engaged in the difficult fields of this exploration, extending over a sphere of country two thousand miles long by two to four hundred wide, and the admirable and triumphant solution of the great railroad problem intrusted to our hands, repaid each man for his arduous labors, and relieved all minds of further doubt and anxiety.

Two barometers only now remained, and the animals were thin and leg-weary from their long labors. The known want of grass for some three days, immediately west of the Cascades, required grain to be taken along, which could not be procured, and the lines, already extended through the two practicable passes, could be taken up on reaching Puget sound and carried to a good harbor. Accordingly, in an order which is marked 8 in the appendix, I sent the whole force to Wallah-Wallah and the Dalles.

Lieutenant Donelson reports the route from the debouche of the pass at Hell Gate to the banks of the Spokane, at the junction of the route from Colville, and that one by the Cœur d'Alene mountains, taken by me as practicable for a road, involving no other difficulties than are usually met with in the Atlantic States, and that it will well connect with a route through the Marias Pass, should a practicable one be ascertained by Mr. Tinkham. The grass generally on his route was good, there having been a scarcity only two nights. He fitted out Mr. Tinkham's party for this difficult work to his entire satisfaction, and at the last crossing of Clark's fork he despatched, in conformity with my instructions, Lieutenant Arnold to Fort Colville, with a thoroughly organized detached party, with instruments for the determination of the barometric profile and the latitude. At Colville I left instructions to Lieutenant Arnold to place his animals and most of his men in camp, to ascend the main Columbia in canoes to the 49th parallel, and there ascertain the important facts of the geography, and to send word by Indian runners to Dr. Suckley to cross by land from the Pend d'Oreille mission to Colville, the navigation thence to Colville being dangerous and almost impracticable; and I left it discretionary with Lieutenant Arnold to go to Wallah-Wallah from Colville either by land, along its left bank, or in boats, leaving also Dr. Suckley a like discretion in reference to my original instructions.

For my instructions to Lieutenant Arnold, see paper 9 from Colville, (this paper has been mislaid,) paper 10 from Camp Washington; and to Dr. Suckley, see paper 11, also from Camp Washington. I will here observe that on the route from St. Mary's valley I met many Pend d'Oreille Indians, and took measures which I trust secured Dr. Suckley an Indian guide the whole distance from Fort Owen to the Pend d'Oreille mission. I also was able to do something towards bringing into relations with Lieutenant Mullan all the Indians going to the buffalo hunt. They have a common route through the St. Mary's valley, and pass within a short distance of Fort Owen.

In a letter received from Lieutenant Arnold by the Hudson's Bay express, and which is given in paper 12 in the appendix, (this has been mislaid,) I learned that he reached Colville with his party on the 31st of October, and that after making the examinations required of the Columbia, in the vicinity of the 49th parallel, he should decide to go to Wallah-Wallah by land; and I am assured by that chivalric and American-hearted man, A. McDonald, Esq., the factor in charge of the Colville post, that he would render him every assistance in his power. With it and the examination already made, we shall have an excellent general knowledge of the country from Colville to Wallah-Wallah, and the several crossings of the Columbia, Spokane, and Snake rivers, and be able to connect the best pass of the Cascades with that of the Cœur d'Alene range. It was in moving from Colville and the Clark river crossing, on the morning of the 26th of October, that the only snow on the entire route fell. It was to the depth of some three to six inches, and disappeared in a few days.

Camp Washington was broken up on the 29th, 30th, and 31st of October, and Wallah-Wallah was reached by myself on the 2d of November, by Lieutenant Donelson on the 6th, and Captain McClellan on the 7th of that month.

Here I learned that the emigrant wagons had succeeded in crossing to the sound by the Nahchess Pass, and learning from Pu-pu-mux-mux, the Wallah-Wallah chief, that his people were now going through it on horseback, and being satisfied, from the known height of the pass, the general character of the season as shown in the quantity of snow on the Blue mountains, and the inferences to be drawn from the extraordinary mildness of the Puget sound climate, that it would be practicable for some twenty days, I assigned Mr. Lander to the duty of carrying over it the odometer survey, of observing the general character of that range as regards railroad constructions, and of adding to our knowledge of the meteorology of that region. I have not a copy of that order with me, but will send it in a future communication.

To fit out Mr. Lander for that duty, I got horses and grain; but the day after my departure Indians came in with information that snow had fallen in the pass, that the last emigrants had lost their animals in it, and that even Indians had been compelled to turn back. Mr. Lander then determined to follow in the trail of the other parties to the Dalles.

Although I regret Mr. Lander did not persevere, I do not censure him for his course. In a new country it is very difficult to get the truth from the information given, and it has been found to be our most vexatious experience on the whole march. But it would have proved, in my judgment, an entirely practicable undertaking, and would have made our information more complete. I have reason to believe that, even at this time, there is but little snow in that pass.

At Wallah-Wallah I learned definitely of the arrival of Lieutenant Macfeely, in charge of Lieutenant Saxton's return party from Fort Owen, and of Dr. Evans, the geologist of the expedition. Lieutenant Macfeely had much difficulty in finding suitable camps, they being in some cases off the route; and he, having no guide with him, and for want of grass, lost many of his animals. Dr. Evans came through rapidly, and brought in all his animals in excellent condition. These gentlemen are now preparing their reports—Lieutenant Macfeely at Columbia barracks, and Dr. Evans at Oregon City.

I reached the Dalles on the 12th of November, Columbia barracks on the 16th, and this place on the 26th; and have made the following arrangements for continuing the survey to this point, for office-work, and for the wintering of animals and the discharge of men:

1. Forty-five feeble animals placed in good grazing in the Wallah-Wallah valley, under the charge of a herdsman; pay, thirty dollars per month and subsistence.

2. About one hundred and twenty-five animals in grazing at the Dalles, in charge of a master herder; pay, sixty dollars per month; and three men, each forty-five dollars per month, with their subsistence.

3. Two small parties by land to Vancouver, under, respectively, Captain McClellan and Lieutenant Donelson, and the remainder by the Columbia river.

4. Quartermaster employés, and gentlemen of the survey whose services are no longer required, discharged at Columbia barracks.

5. The office established at Olympia, and the odometer survey continued by the line of the Cowlitz to that point.

6. The railroad line to be run from the Snoqualme Pass to the sound by Captain McClellan, and a winter post to be established near the pass.

The parties of Captain McClellan and Lieutenant Donelson have reached Columbia barracks; the men not needed have been discharged, and the remainder are on their way to this place.

The parties of Lieutenant Arnold, Dr. Suckley, and Mr. Tinkham, are expected to reach this point in all this month. Lieutenant Grover is not expected till late in February or early in March, at which time I hope to receive from Lieutenant Mullan a report of his route to Fort Hall. I propose, in February, to send Lieutenant Arnold through the Nez Perces country to the Cœur d'Alene mission, and from that point make arrangements to ascertain the snows in the Cœur d'Alene mountains.

Apologising for this hastily written and desultory report, I remain, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War.

No. 1.

ST. MARY'S VILLAGE, WASHINGTON TERRITORY,
October 2, 1853.

SIR: I have the honor to report my arrival at this place at noon of the 30th of September. In conformity to your letter of instructions to me, dated at Fort Benton, September 8, 1853, I left Fort Benton on the morning of the 9th, and struck the Muscle Shell river on the 13th, passing between the Highwood and Girdle mountains, near the base of the western slope of the Highwood mountains. Here I found a most excellent prairie road from the Missouri to the point where I struck the Muscle Shell river, with the exception of about three miles of "bad land" crossing. On my route from the Missouri I crossed the headwaters of the Shonkee creek, or Shonkee river, Arrow river, Judith river, and Hammell Island creek, before striking the Muscle Shell river. All of these streams referred to are tributaries of the Missouri from the south, but lose their importance when compared with the Muscle Shell river. This last mentioned stream I found to be one of the most important tributaries of the Missouri. It takes its rise in the main chain of the Belt or Girdle mountains, a chain of the Rocky mountains east of the Missouri. This river winds through a very beautiful, level valley, well wooded along the borders of the stream from its headwaters to the point where I struck it, a distance of sixty miles, and I have every reason to believe that it is well wooded thence to its mouth. The valley through which it flows is about one mile wide, bounded on the east side by low prairie bluffs. There are two trails across the mountains by this river—one by the northern, and the other by the southern fork of the river. In coursing the southern fork of the Muscle Shell river you cross the headwaters of the Missouri; in crossing along the northern fork you pass though the Girdle mountains, by a very excellent pass, to the Missouri.

I did not fall upon the Flathead trail when I first struck the river, but found it four miles above, which I saw tended towards the east. This trail I followed for a distance of twenty miles to a ford. I thence followed it southeast to the Muscle Shell, for a distance of twenty miles farther, over a very rough, rugged, and difficult road. There I found that the Flatheads were five days ahead of me, and that it would be perfectly impossible for me to overtake them with my pack animals. Therefore I deemed it advisable to go into camp—which I left in charge of Mr. Burr—to go in search of the Flatheads, with my Indian guide. To this effect the Indian guide and myself, mounted on two of my best horses, followed on their trail for a distance of sixty or seventy miles, and found them encamped in a very beautiful valley. Here I was received by them with the greatest hospitality and kindness. I explained to the principal men of the camp, in detail, the object of my visit. I told them that I came among them to secure a delegation of their most intelligent and reliable men to accompany me across the Rocky mountains, to meet you at the St. Mary's village. I told them that you had visited the camp of the Blackfeet Indians, and that your intention and determination was to bring all the tribes, both east and west of the mountains, into one general peace; that your determination was to protect them from the incursions of the Blackfeet Indians, who for years have been their enemies to the knife; that your determination was to build anew the village of St. Mary's, and cause the valley, where had been their homes for years, again to teem with beauty; that, in the beautiful valley of St. Mary's, a foundation had been laid, and that upon it you intended to build, if possible, a superstructure that all the Indian tribes of North America could look upon and imitate, and that would be a monument which our government could view with feelings of pride and credit. After much persuasion, the chief of the tribe delegated five of his principal men to accompany me, to be their representatives to you. Four of them accompanied me to this village, and I am compelled to bear witness, on an occasion, to their noble and Christian character. Did what Father De Smet has told of the Flathead Indians need confirmation, I am ready and willing to add my evidence in the behalf of these interesting children of the mountains.

From the Flathead camp I followed up the Muscle Shell river to its headwaters, by its northern fork. I there fell upon the headwaters of Smith river, flowing into the Missouri from the south, and running in a northwesterly course by a very excellent prairie road across the dividing ridge. This river takes its rise in the same range of mountains as the Muscle Shell, and flows in the opposite direction. This river winds through a very beautiful prairie valley, well wooded. The current of the stream is rapid, bed rocky, and water about eighteen inches deep. This valley I followed down for many miles, and, finding it to take a course too far to the north, I left it and crossed to the Missouri by a very excellent road. Here I found the Missouri to be five feet deep and about thirty yards wide, and flowing with a very rapid current towards the north. The water here is perfectly clear and limpid. From the point where I struck the Missouri there is a very excellent prairie road leading westward; but being unable to ford the stream where I struck it, I was compelled to follow down the course of it for eight miles to find a ford, and then crossed a high ridge of mountains west of the Missouri, in order to cut off the distance to my left. This prairie extends about twenty miles to the west, to the dividing ridge, where rises the main fork of the Bitter Root river. This dividing ridge, from which flow the waters of the Missouri and the Columbia, I crossed on the second day from the Missouri, and it proved the only difficult point of passage in my route from Fort Benton. This divide is about four hundred feet high, and about three miles across. I here fell upon the headwaters of the main fork of the Bitter Root river, the valley of which I followed down till it unites with the Blackfeet fork of the Bitter Root river at Hell Gate. This valley is about a mile wide, and well wooded with the pine and cotton-wood tree, and affords a most excellent road for the passage of wagons. There is a well-beaten trail along this valley, made by the Flatheads in their course to their hunting-grounds east of the Missouri. I would here mention that this same trail leads along the north fork of the Muscle Shell river; thence down the river to its mouth. The grade of this valley is scarcely perceptible, and along it you pass along the slope of but one mountain, which, with but little trouble, would allow wagons to pass over it. After leaving the main fork, I crossed the Blackfeet fork of the Bitter Root, and followed along it for six or eight miles, and thence crossed to the St. Mary's by a most excellent prairie road. I found good grass and water for my animals on nearly the whole route, and slept but one night without wood, which was between the Missouri and Muscle Shell. I would mention particularly the valleys of the Muscle Shell and the main fork of the Bitter Root rivers, as being well grassed. I found, in both valleys, the grass green, rich, and luxuriant, and water and wood in abundance. This wood I found to be principally the pine, cotton-wood, spruce, cedar, and hemlock. I would also mention that game in the greatest abundance is to be found along the whole route—buffalo, elk, antelope, and bear. I would also mention that I found the weather much more mild west of the Missouri than east of it. For full details as to the character of the country, for each day's march, and the streams and rivers passed, I would refer you to my journal.

I have the honor to be, sir, your obedient servant,

J. MULLAN,
Lieutenant United States Army.

Hon. ISAAC I. STEVENS,
Governor of Washington Territory.

No. 2.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Fort Owen, St. Mary's Valley, October 3, 1853.

DEAR SIR: You are placed in charge of the meteorological and supply post established in this valley, with Mr. Adams and Mr. Burr, assistants; Sergeant Simpson, in charge of the animals; Corporal Rose, Privates Wolfe Williams and Toohill Isham, of the 7th infantry; and Simpson, Farnham, Osborne, Osborne, jr., Mechelbach, and Bell, quartermaster employés, and Gates, to be chargeable to the survey.

The object in establishing this post is twofold: first, to ascertain the character of the seasons in this valley, and the adjacent ranges of mountains, by numerous and carefully-made meteorological observations; and, second, to continue the exploration and survey of the country between the Rocky and Bitter Root ranges of mountains, extending it to Fort Hall, to connect with the survey of Fremont, and northward to the Flathead lake, and even to the upper waters of Clark's fork. As much time as practicable should be given to the examination of entrances to passes. It is believed you will be able to work late, and to resume operations at an early period in the spring.

It is important that attention should be given to collections, and particularly to the mineral wealth of the region. Gold is said to be found in the neighborhood of the Hell Gate fork. I desire you to pay especial attention to the Indian duties connected with your position. You are authorized to pay an interpreter at the rate of $500 per year. He should, as you have suggested, be a guide; and the Flathead, Gahiel, is recommended as competent and reliable: endeavor to secure his services. Your attention is called to the several particulars in relation to which I am directed to make reports in the instructions of the Commissioner of Indian Affairs, and any information you can afford will be of service. Make an estimate of the probable cost of establishing a sub-agency, and the general cost of keeping it up. I shall, however, endeavor to communicate with you again this fall, and may be able to send you additional Indian goods.

To Lieutenant Grover, who has volunteered to conduct the dog train over these mountains in the winter, and to Mr. Tinkham, who has volunteered to cross the mountains twice by the Marias Pass to Fort Benton, and thence by some southern pass to this point, and thence by the southern Nez Perces to Wallah-Wallah, you will, of course, render all the assistance in your power. Ample supplies have been provided for them, and I do not think any contingency will arise making it necessary that they should encroach upon your stores.

By Lieutenant Grover and Mr. Tinkham, I hope you will be able to send reports of your operations, or detached reports, with a statement of your route from Fort Benton to this point, and of your survey to Fort Hall, should it be accomplished before the arrival of Lieutenant Grover.

You may rely upon my establishing at least a bi-monthly express there this winter, if practicable, and by which I shall be able to hear from you twice, and perhaps three times, before I see you in the spring. I shall endeavor to visit this place previous to the 15th of June.

Of the animals (horses and mules) left in your charge, I am confident that as many of them will be serviceable, in a few days, as your duties will require. Should the winter prove mild, all the animals will probably be serviceable in the spring. For the meat rations you will rely mainly upon beef, which is in abundance in this valley. Lieutenant Saxton established the tariff at $60 per head, which meets my approval.

Yours, truly,

ISAAC I. STEVENS.

Lieutenant MULLAN.

No. 3.

FLATHEAD VILLAGE OF ST. MARY'S,
Territory of Washington, October 2, 1853.

SIR: According to the verbal instructions you have already received, you are placed in command of the principal party to continue the work westward from this point, to connect with Captain McClellan's work eastward, through the Cascade range. The party will be composed as follows: Lieutenant Arnold, U. S. Army, assisted by Mr. Lyman Arnold, and Mr. G. W. Stevens, assisted by Sapper Roach, associated in the charge of the astronomical observations.

Mr. Lambert, the topographer of the expedition, in charge of the odometer survey, assisted by Mr. Bixly.

Mr. Lander, civil engineer; Mr. Moffett, in charge of meteorological observations, assisted by Sapper Davis; Messrs. Kendall, Evans, Evelyn, and West, as general assistants; Sergeant Higgins, pack-master, assisted by Mr. Henderson and Sergeant Martin; Sergeant Lindez, quartermaster, commissary, and ordnance sergeant; Private Horner, assistant in making collections; Private Goercky, of the dragoons, hospital steward; Corporal Cunningham, Privates Brandnell and Smith, of the sappers and miners; Privates Mathers and Bowers, of the fourth infantry; Gear, Hudson, and Williams, chargeable, to the survey, and twenty-seven employés of the quartermaster and commissary department. Camille is assigned as an interpreter, with an Indian guide of the Flathead tribe.

Your general course will be by the Jocko river to the Clark's fork of the Columbia, thence to where the fork was crossed by Lieutenant Saxton, westward of the Pend d'Oreille lake, taking either the route passed over by Lieutenant Saxton, or some practicable route between Clark's fork and the Kootenaies river, and thence to near the Spokane house, at the crossing of the Spokane river. Assign to Mr. Lander such duties in connexion with the railroad estimate and side reconnaissance as will give the best result. The Bitter Root river should be examined, and the route by Clark's fork reviewed, even should the general route be more to the north. At the Pend d'Oreille lake, a detached party, sent to Colville by the northern trail, might intercept Captain McClellan; and at Colville, would be in a position to move westward to open a connexion with his work. The Spokane crossing, near the Spokane house, is a central position, trains leading therefrom both to Colville and Wallah-Wallah. At the crossing you may expect intelligence of Captain McClellan's movements, and additional instructions either from Captain McClellan or *myself*. Failing to receive intelligence or instructions, your general course will be Olympia, by Wallah-Wallah, and the military road to Nisqually, and thence to Olympia. But you have full discretion to reach Olympia, from the Spokane house, by any other practicable route which may be detected in your progress through the country, taking the precaution, however, to communicate with Wallah-Wallah, where instructions may await you to the end, and by express purpose generally. At least six good horses should be reserved by you. The party to Colville by the northern trail, from the crossing west of the Pend d'Oreille lake, place under the charge of Lieutenant Arnold, and instruct him, if he fail to hear from Captain McClellan at Colville, to push beyond Colville to the base of the Cascade range; and thence move to the south, along the eastern base of that range. Recollect the great object to be accomplished, in the direction given by your operations, including those to Lieutenant Arnold, is to connect your work with that of Captain McClellan, through the most practicable pass found in the Cascade range by him; and to this every movement should tend. To this end you will instruct Lieutenant Arnold, as he moves south, either to reach Olympia by Wallah-Wallah and the military road, or by some other practicable route, as you may judge most judicious.

In reference to Lieutenant Arnold's party, I will suggest that it be immediately organized, to be prepared for any duties of reconnaissance, on which it may be desirable to detach him, previously to arriving at the Clark's fork crossing. It should be a most efficiently organized party. Besides his brother's assistance in astronomical observations, it is desirable he should have an assistant for the compass line and topography, and an assistant for barometrical observations. Endeavor so to organize his party, unless the deficiency of instruments renders it impossible. I am of opinion that Mr. Lander's party should consist of not more than three men besides himself. As you approach the country of the Kootenaies Indians, every exertion should be made to secure their services as guides, as they are said to be well acquainted with the routes you will take. You are requested to obtain every information possible in reference to the Indian tribes you may meet, and I can recommend Mr. Kendall as one who would render much assistance in this important branch of the work. You are also requested to learn what you can in reference to the missions situated in the vicinity of your route, and also of the Hudson's Bay settlements; of both, whether their influence is beneficial or prejudicial to American interests in their neighborhood.

Enclosed you will find letters of introduction to officers in charge of Hudson's Bay posts at Colville and Wallah-Wallah.

Truly yours, &c.,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

Lieut. A. J. DONELSON,
United States Corps of Engineers.

No. 4.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Flathead Village, St. Mary's Valley, October 2, 1853.

SIR: You will remain at this point until the 25th instant or thereabouts, when you will proceed in a canoe down the Bitter Root and St. Mary's rivers, through by Lake Pend d'Oreille, and down Clark's fork of the Columbia river to the main river, following the latter to the mouth of the Cowlitz; and from that point make your way by the most practicable route to Olympia.

During your stay at this place you will employ your time to the best advantage, collecting such specimens in zoology, botany, ichthyology, &c., as may be rare and interesting; and in your intercourse with the natives, making yourself familiar with their past and present history, language, traditions, &c., as fully as possible. Henry Berry and George Smith, two experienced boatmen, will be placed at your disposal, and, where necessary, you are empowered to hire an Indian guide. During your trip, in addition to collections in natural history, you will note carefully the general direction of these rivers, and of their main tributaries, the various falls and rapids, and their approximate distances; note also the width and depth of the stream, the character of its banks at various points, and any other interesting and valuable facts. You will also make a set of meteorological observations at regular intervals, for which purpose the proper instruments will be furnished you.

You will collect all the information you can concerning the various missions on your route, noting carefully their influence, both in connexion with the settlement of the country and as tending to promote the civilization of the native tribes.

I will place at your disposal letters of credit and introduction to the agents of the Hudson's Bay Company at the posts of Fort Colville, Wallah-Wallah, and Vancouver, with discretionary powers as to their use.

Very truly yours, &c.,
ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Expedition.

Dr. GEORGE SUCKLEY.

No. 5.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
St. Mary's Valley, Washington Territory, October 3, 1853.

DEAR SIR: With your party you are assigned to the duty of examining the Marias Pass, and returning either by Cadotte's Pass or by the pass pursued by Mr. Mullan, or by that entering the valley above this point, from the Jefferson fork of the Missouri, and known as the main Flathead trail, and thence by the southern Nez Perces trail to Wallah-Wallah, and the military road to Olympia. Fort Benton will be visited by you to confer with Mr. Doty, and make known to him the several routes examined, and to advise in relation to points requiring examination; should it be practicable, it would be desirable that Mr. Doty should accompany you to St. Mary's, and thence return by Cadotte's Pass to Fort Benton.

It is desirable that you should return by the broad Flathead trail; but the season is late, and it may be found necessary to come here by the shortest route, that of Cadotte's Pass. It is probable that with good pack animals, the route by Cadotte's Pass will occupy ten days; that by Mr. Mullan's, twelve; and by the broad Flathead trail, fifteen days. In addition to the railroad reconnaissance and estimate, estimate as to the cost, and report as to the best practicable method of establishing a wagon route from Fort Benton to this point.

Your guide will be a Flathead Indian, who will accompany you to the entrance of the Marias

Pass, and the voyageurs Monroe and Dauphin are assigned to your party. Mr. Doty and Lieutenant Mullan will be directed to afford you every assistance in their power, particularly in giving you good animals. Lieutenant Mullan will furnish a Nez Perces guide, and additional instructions will await you at Wallah-Wallah.

Your labors will be arduous, and will contribute greatly to the value and interests of the expedition, and you enter upon them with my entire confidence as to their successful accomplishment.

Yours, &c.,

ISAAC I. STEVENS.

Mr. TINKHAM.

No. 6.

NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
St. Mary's Valley, October 3, 1853.

MY DEAR SIR: I send you by Mr. Monroe a sketch of the several routes already examined from Fort Benton to this point, to which Mr. Tinkham will add, on his arrival at Fort Benton, the routes examined by him.

1st. A route from the Blackfeet fork to the Jocko river; and, 2d, a route by the Marias Pass, from this point to Fort Benton. I have requested Mr. Tinkham to make known to you the character of these several examinations, and to confer with you in relation to the best direction to be given to your work from Fort Benton. Should it be deemed by you practicable, or compatible with your other duties, you will accompany Mr. Tinkham to this point to confer with Mr. Mullan, and then return to Fort Benton. My object is to bring the operations, by way of conference between the two parties, and the communicability of information, into connexion, so that the best results may be accomplished. I earnestly desire this to be done, and I am satisfied it is entirely practicable. The Flatheads pass the mountains all through the fall, and till after new year's. All this is, however, left to your own judgment and discretion, in which I place entire confidence. It will be necessary that the animals be kept in the best possible condition—oxen, horses, and mules. The operations of the winter will be more extensive than was anticipated, and it is of the greatest consequence that every animal be in condition for service. You may expect Mr. Tinkham by the 20th instant, and it is important that he should have an effective train to return. The two ponies which I left with you must not be put to the hard work of crossing the mountains, but the remaining animals may be brought into requisition. At this point we leave nearly eighty animals, sixty of which will be effective in the course of this month, and will be sufficient for Mr. Tinkham's route to the Pacific from this point, to provide for your return to Fort Benton, and for the operations of Mr. Mullan, who has with him fifteen men.

Our operations to this point have been very successful. The principal party under Lieutenant Donelson moved yesterday. I move to-day to visit Colville, and thence make the best of my way to the sound.

Yours truly,

ISAAC I. STEVENS.

Mr. DOTY.

CAMP ON ST. MARY'S RIVER,
Thirty-three Miles below St. Mary's Village, October 7, 1853.

Mr. Tinkham got in last evening, and starts on his examination this morning.

Since writing the above I have met Victor, the chief of the Flatheads, and nine lodges of Flathead Indians. He starts in two days across the mountains on a buffalo hunt, and will return in November. His people will remain till after Christmas: so much for these horrible mountains.

Monroe, Baptiste, and the two Piegans go by Cadotte's Pass. One of the Piegans has agreed to accompany you to St. Mary's, and to return with you to Fort Benton. He is the more delicate Indian of the two, and the better Indian. He guided me to St. Mary's and is very trustworthy. In reference to the service of Monroe, Baptiste, and the two Indians, I shall write a special letter.

Yours, &c.,

ISAAC I. STEVENS.

Mr. Dotty.

No. 7.

Northern Pacific Railroad Exploration and Survey,
St. Mary's Valley, October 3, 1853.

My Dear Grover: We have had good success in coming through the mountains: fine weather and no snow. All the parties were here on the 30th September, except that of Mr. Tinkham, who is out examining a route from the valley of the Blackfeet river to the Jocko river to see if the defile ending in Hell Gate cannot be avoided. Donelson left yesterday in charge of the principal party, and I shall move off in the morning, and hope to reach Fort Colville in ten to twelve days.

In your examination of the Dalles, I will thank you to examine as to the site of a suitable depot for emigrant purposes, and for the continuation of the survey. It should be in the neighborhood of grass and wood, and as near as practicable to the head of steamboat navigation. I have left a good store of provisions for you at this point, and shall make every exertion to send here an express in November from the sound. I am decidedly of the opinion that you will accomplish the undertaking of the dog train.

Lieutenant Mullan is left in charge here, with Messrs. Adams and Burr as assistants, Sergeant Simpson in charge of animals, and twelve men. He will assist you in every way in his power.

The doctors will also remain here some twenty days, with two men, and then go down the St. Mary's river and the Columbia in a boat.

I shall expect to see you in Olympia some time in February, and to congratulate you on the success of your enterprise.

Yours, &c.,

ISAAC I. STEVENS.

Camp St. Mary's Valley,
Thirty-three Miles below St. Mary's Village, October 7, 1853.

Mr. Tinkham got in last evening, and starts on his examination to-morrow. He will reach Fort Benton by the 20th instant, and is accompanied by a good Flathead guide.

No. 9.

[Orders.]

Northern Pacific Railroad Exploration and Survey,
Camp Washington, October 29, 1853.

The chief of the exploration congratulates his associates upon the junction of the eastern and western divisions on the banks of the Spokane river, and for the successful accomplishment of the great object of their joint labors. To Captain McClellan, his officers and men, too much credit cannot be ascribed for their indefatigable exertions, and the great ability of all kinds brought to their division of the work. They can point with just pride to the determination of two practicable passes in that most formidable barrier from the Mississippi to the Pacific, of the

Cascade range, and to a most admirable development of the unknown geography of the region eastward to the Columbia, as showing the unsurpassed skill and devotion which has characterized the chief of the division and all of his associates.

To Lieutenant Donelson and his command thanks have already been tendered for their previous services. But special commendation is now due for the constancy and success which have crowned their labors on their difficult line of Clark's fork, from the St. Mary's village to this point. The detached party under Lieutenant Grover, engaged in the survey of the upper Missouri, and about to cross the mountains with a dog train; the parties under Lieutenant Arnold, now at Fort Colville; under Lieutenant Mullan, now exploring the route from the St. Mary's valley to Fort Hall; under Dr. Suckley, on his way in a boat, with two men, from the St. Mary's valley by that river, Clark's fork, and the Columbia, to Fort Colville; Mr. Tinkham, engaged in the exploration of the Marias Pass and the broad Flathead trail; and Mr. Doty, in charge of a meteorological party at Fort Benton, must not be forgotten. They have all developed ability of a high order in the progress of the exploration. No one doubts that success will crown their labors.

The chief of the exploration would do injustice to his own feelings if he omitted to express his admiration for the various labors of Mr. Stanley, the artist of the exploration. Besides occupying his professional field with an ability above any commendation which we can bestow, Mr. Stanley has surveyed two routes—from Fort Benton to the Cypress mountain, and from the St. Mary's valley to Fort Colville over the Bitter Root range of mountains—to the furtherance of our geographical information, and the ascertaining of important points in the question of a railroad; and he has also rendered effectual services in both cases, and throughout his services with the exploration, in intercourse with the Indians.

Our labors are near their conclusion for the present season, and it only remains to go into quarters. The two divisions, under the respective commands of Captain McClellan and Lieutenant Donelson, will proceed to the Columbia barracks by way of Wallah-Wallah and the Dalles, and then await instructions as to the discharge of their men and the arrangements for the office-work. The animals will be left at Wallah-Wallah and the Dalles, in the charge of trustworthy men, to be cared for during the winter, in readiness for operations in the spring.

ISAAC I. STEVENS,

Governor of Washington Territory, in Charge of Exploring Expedition, &c.

No. 10.

CAMP WASHINGTON,
Twelve Miles South of Spokane House, October 29, 1853.

SIR: We met the party of Lieutenant Donelson at this place yesterday, and from him I learned that you probably reached Colville yesterday. Besides the instructions which I left there for you with Mr. McDonald, I have only to suggest that in your route to Wallah-Wallah it will be well to examine the Grande Coulée. It is left free with you, however, to decide, should the lateness of the season or the condition of your animals make it advisable, whether you will take this route or pursue the best known trail to Wallah-Wallah, concerning which you can receive full information from Mr. McDonald. You are authorized, should your judgment dictate it, to leave your animals at Colville, making arrangements with McDonald for their safe-keeping; and, in connexion with Dr. Suckley, to descend the Columbia river in a boat, making the best survey you can. I send you a memorandum of points, in the line of the Columbia, particularly requiring attention, which has been proposed by Captain McClellan. Although it is desirable to meet Dr. Suckley, and with him confer upon your own and his future operations, it must not be done at the expense of too much time; and you are authorized, should you not meet him at Colville on your return from the upper Columbia, to move at once to Wallah-

Wallah. At Wallah-Wallah you will receive additional instructions. We have met Garry, the chief of the Spokanes, and I am highly pleased with him. He is a man of entire honesty and great energy, and well calculated to be chief of his tribe. Under his auspices I think his people will improve rapidly. You are aware of my wish to establish a meteorological post between the Cascade and Bitter Root mountains.

I wish you would consider this matter and endeavor to advise me in regard to its location and the manner in which it should be conducted. Three places come into competition, Wallah-Wallah, Fort Colville, and the Spokane river; and I am at present inclined to the opinion that Wallah-Wallah is the most suitable.

Give all the attention you possibly can to the Indians, particularly to the Spokane and Nez Perces.

Yours, &c.,

ISAAC I. STEVENS.

Lieut. R. Arnold, *4th Artillery*.

No. 11.

Camp Washington,
Twelve Miles South of Spokane House, October 29, 1853.

Dear Sir: I have learned from Mr. McDonald, at Colville, that the Hudson's Bay people never attempt the passage of the Columbia in boats from the Pend d'Oreille mission; and I have therefore requested Lieutenant Arnold, now at Colville, to send to the mission a guide, and with the suggestion that you come from that point by land.

My object in this is to inform you, so far as I learn, of the dangers ahead, that you may not be exposed to unnecessary risk. I have also suggested to Lieutenant Arnold, that, on your meeting him at Colville, you should mutually confer in reference to your future operations.

You may deem it advisable to accompany him by land, and I have given to him authority, should the lateness of the season or the condition of his animals forbid his journey by land, to descend the river in a boat; in which case I shall wish to have you go together. My object in making these suggestions is to guard yourself and your men from unnecessary risk, and not to interfere in the slightest degree with the field you wish to occupy. I wish that field should be occupied as fully as the lateness of the season and the means in your power will permit, that the best results may be gained.

Yours, truly,

ISAAC I. STEVENS,
Governor of Washington Territory, &c.

Dr. George Suckley.

No. 13.

Camp Washington,
Twelve Miles South of Spokane House, October 29, 1853.

Dear Sir: Our eastern and western divisions have met at this point, and the train has now been carried entirely across. Captain McClellan has discovered two passes in the Cascade range, north of Mount Rainier, and has explored the whole range from the Columbia to the 49th parallel. He and the officers with him are in excellent health, and have done an immense amount of work. Last evening we had a little supper or meeting of the gentlemen of the two divisions, at which your name, and those of other gentlemen on detached service, were not forgotten. I have borne constantly in mind what I told you in regard to supplying provisions and Indian goods, and I will avail myself of the very first opportunity to do so.

I hope to meet Mr. Owen, by whom I will send some powder; and I think you will be able to get from him some sugar, coffee, and other indispensable articles. As regards the expresses, I shall make every endeavor to establish them, but may not succeed.

It is a matter which I deem of very great importance, that you should receive intelligence from us, and that we should hear of your movements; and you may rest assured that no effort on my part will be wanting.

Our parties are all now to move to Wallah-Wallah and the Dalles, where we shall leave the animals; thence to Columbia barracks, when the men will be discharged and the office force made up, which will proceed to Olympia by way of the Columbia and Cowlitz rivers.

Yours, truly,

ISAAC I. STEVENS.

Lieutenant MULLAN,
St. Mary's Village.

No. 14.

CAMP WASHINGTON,
Twelve Miles South of Spokane House, October 29, 1853.

DEAR SIR: We have met at this place the eastern and western divisions, and our success is complete. Captain McClellan has found two passes through the Cascade ridge, north of Mount Rainier. Last evening we had a supper, at which you were particularly remembered, and your services referred to.

I have met Jack, the guide of Lieutenant Macfeely, who speaks of the Nez Perces trail to Wallah-Wallah as quite severe. They were twenty-two days in going—stopping two days, however, for a missing man—and lost twenty animals. They did not get on the true trail, however; in the words of the guide, they struck too high up. This letter will probably reach St. Mary's about the time of your arrival there; and I think before deciding to go by the southern Nez Perces route, in conformity with instructions already received, you should get all possible information from the Indians.

There seems to be no doubt that the route by Clark's fork, taken by Lieutenants Saxton and Donelson, is the best in a severe season; and you have authority, should your information lead you to the belief that the Nez Perces route will expose you to too much risk, to take this route.

In reference to the goods for your guide, I have them together, and will send them by Mr. Owen, if we meet him, as I trust we shall; but if not, you had better arrange with Mr. Owen, at St. Mary's, to pay him there.

All parties will move from this point to Wallah-Wallah and the Dalles, where the animals will be left over winter; thence to Columbia barracks, when the men will be discharged, and then to Olympia for office-work.

Truly yours, &c.,

ISAAC I. STEVENS.

N. B.—The goods for your guide are as follows: four blankets, four pair leggins (cloth.)

A. W. TINKHAM.

OLYMPIA, WASHINGTON TERRITORY,
December 19, 1853.

SIR: During the last week the parties of Captain McClellan and Lieutenant Donelson have reached Olympia, and are now prepared to enter upon the office-work. During this week Captain McClellan will leave this place to explore the region west of the Cascade mountains, with a view of bringing the railroad line down to a good harbor on Puget sound; to determine the proper location of the military road, and to examine the work already executed upon it. The mild weather we are now experiencing will favor his operations greatly. I shall here establish a meteorological post, keeping up a series of complete observations during the winter. The latitude and longitude will also be determined with all possible accuracy. I am pleased to be able to report the arrival of Dr. Suckley, with his little party. His trip by canoe from the St. Mary's village has been entirely successful, having accomplished the entire distance to Fort Vancouver by water, with the exception of about sixty miles above Fort Colville, where the rapids are so frequent and dangerous in their nature that its passage by water is seldom attempted. I will, in the following extract from his report, give the results achieved by him:

"* * * Agreeable to instructions received from you, dated October 2, I had considerable difficulty in making a canoe which would answer the purpose. A skin boat, made of three bullock's hides, was at length constructed, and on the 15th of the same month I embarked with two white men and an Indian, to descend the Bitter Root river. The inhabitants of St. Mary's were entirely unacquainted with the nature of the river, and its capabilities for canoe navigation, no boats ever having been known to ascend the river higher than the Horse Plain, just below the junction of the St. Mary's and Pend d'Oreille rivers. My trip being considered so hazardous, I was obliged to proceed with great caution, and it was not until the eleventh day that I reached the latter river. On the twenty-fifth day after my departure from St. Mary's, I reached the Pend d'Oreille mission. My provision had entirely given out, but, thanks to the kindness and hospitality of the good missionaries at that point, my stock was replenished. Here I found that the skin canoe had become so rotten that it became necessary, in case I proceeded farther by water, to obtain a new boat. Owing to the miscarriage of some letters of instruction which had been sent to me from you, and from a wrong impression on the minds of the priests, to the effect that they had heard of your having sent positive orders to me to relinquish the trip, I was reluctantly compelled to take horses and proceed to Fort Colville, on the Columbia river, distant sixty miles by land. The distance by the river may be a little more. It is my opinion, from what I could learn from observation and report, that I could have descended the Clark river to that point, although, of course, I should have been obliged to use great caution, as nothing definite is known by the Indians or others concerning this part of the river. I suppose that the river would be navigated by the Indians, in their canoes, if there was any inducement. Their hunting grounds lie in an opposite direction, and they are too indolent to travel for the sake of exploring or for pastime. On the 13th of November I arrived at Fort Colville, where I obtained further supplies, two canoes, and three Indians. On the 17th I again embarked, reaching Fort Vancouver on the 6th of December. On the route I stopped at Fort Okinakane, Fort Wallah-Wallah, the Dalles, and Cascades, and obtained such supplies as I needed. The time occupied in making the whole distance was fifty-three days, or two days less than were occupied by the main train, under Lieutenant Donelson, between the same points. The running time, exclusive of stops, was 285½ hours, and the distance, (approximative,) as measured by the course of the rivers, including the greater and lesser bends, one thousand and forty-nine miles. This will give the average speed of 3.774 miles per hour. There were but three portages on the whole route of any magnitude; one of thirteen hundred paces on the Clark river, above Lake Pend d'Oreille; one on the Columbia, at the Dalles, of eight hundred paces; and lastly, one on the Cascades, one and a half mile in length. On the latter, I made use of the wooden railway to convey the canoes and their loads. It should be borne in mind that this passage was made at the lowest stage of water, when the current was proportionately feeble.

"The Bitter Root river was quite shallow in many places, and my canoe, which, when loaded, drew about ten inches of water, had frequently to be lightened. After reaching the St. Mary's river, formed by the junction of the last-mentioned stream and the Hell Gate river, I always had sufficient depth of water. About sixty miles (by the river) below the mouth of the Hell Gate river, the mountains approach very closely to the bed of the stream, rendering its current very swift and tortuous, abounding in rapids. Farther down it is straighter, with large flats on one or both sides, channel deeper, and current more sluggish. At a point about sixty miles above the Pend d'Oreille mission (of St. Ignatius) is the Pend d'Oreille or Kalispem lake, formed by a dilatation of the river. It is a beautiful sheet of water, about forty-five miles in length. Below this the river is sluggish and wide for some twenty-six miles, when rapids are again encountered during low water. From a point nine miles above the lake to these rapids, a distance of about eighty miles, steamboats drawing from twenty to twenty-four inches can readily ascend. In higher water, of course, the distance will be lengthened. There would then be but one bad obstacle between the Cabinet, twenty-five miles above lake Pend d'Oreille, and a point some ten miles below the mission, a distance of one hundred and forty miles. The obstacle alluded to is where the river is divided by a rock island, with a fall of six and a half feet on each side. At this point a lock might readily be constructed.

"The Hudson's Bay Company's large freight boats are in the habit of ascending from the lower end of the Pend d'Oreille lake to the Horse Plain, a distance of 135 miles; this involves two portages.

"On the Columbia river, between the mouths of the Spokane and De Chute's rivers, a distance of about 350 miles, there are but three bad obstacles to navigation for steamboats drawing from twenty to thirty inches. The principal of these are the Priest and Buckland's rapids. These might probably be locked, or so modified by art as to render them passable for steamboats or other craft. The mouth of the De Chute's river is about eight miles above the present steamboat landing at the Dalles. I have dwelt on these particulars, knowing how important this matter will prove, in relation to questions of railroad construction and the transportation of supplies.

"From the Horse Plain, before spoken of, the river, so far as I examined it, would be excellent for rafting purposes. Timber in this manner could be transported a great distance. Above this to the St. Mary's village, I cannot give a decided opinion in its favor, but am inclined to the opinion that rafts might run. At any rate, logs could be readily driven down by the current from an immense distance. While on the subject of timber, I will briefly allude to its quantity and quality. Along the Bitter Root and Hell Gate rivers, and the mountains in their vicinity, the red pine and larch, favorite trees in ship-building, are found in great quantity. The white pine, cotton-wood, and wild cherry are also found, although not in such quantity. Farther down these streams we find, in addition, cypress or cedar, hemlock, spruce and fir, besides several hard-wood trees. The timbered country extends from the main range of the Rocky mountains to a point about eighty miles below Fort Colville. From that to the Dalles there is no timber. At the Dalles it again appears, and trees of many descriptions, and frequently of enormous size, are found thickly covering the valleys and surrounding hills.

"Excellent building stone is found along nearly the whole route. There are pieces of excellent land along the rivers. Their waters are clear and beautiful, and filled with thousands of the different kinds of the salmon family. The country above the Dalles is remarkably healthy." * * *

Dr. Suckley reports that Lieutenant Arnold had reached Wallah-Wallah, and would immediately come on. Lieutenant A. had been entirely successful—had accurately determined the latitude of the mouth of the Clark's fork of the Columbia, and had made an examination of the Grand Coulée, which in its character is found to differ essentially from published results. Mr. Tinkham, now on his way from St. Mary's, is probably through the mountains and within six to ten days of Wallah-Wallah. Our examinations down the line of the Columbia prove it entirely practicable for a railroad, and the line along Cowlitz river and thence to Puget sound is remarkably cheap, as well as easy of construction. Puget sound can certainly be reached by two practicable routes, the line of the Snoqualme Pass with a single tunnel—say three thousand yards long, and with grades not exceeding forty feet—and the line of the Columbia and

Cowlitz, with somewhat easier grades, with no tunnels, but involving an increased distance of, in round numbers, one hundred and fifty miles.

The office-work is commenced with great vigor, and I hope to be able to despatch my preliminary report in a month's time.

I am, sir, very respectfully, your most obedient,

ISAAC I. STEVENS,
Governor of Washington Territory.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington.

WAR DEPARTMENT,
Washington, December 1, 1853.

SIR: I have received, with your letter of the 28th of September, a duplicate of that of September 8th, (the original has not come to hand,) in which you state that the funds allotted for the survey under your charge would be exhausted by the middle of October, from which time to the 30th of June next you would require $30,000, in monthly instalments; and you add an estimate of $40,000 for the operations of your party for the next fiscal year, ending June 30, 1855.

The department very much regrets that, with a full knowledge of the extent of the means at the disposal of the department for the survey intrusted to you, you have so made your arrangements as to absorb all your funds so long before the completion of the work. I have no means of meeting any further demands for the expenses of your party.

In the instructions from this department of April 8, you were directed to bring your operations to a close, and submit a general report before the first Monday in February next, when the law requires all reports to be laid before Congress. All arrangements looking to the extension of your operations beyond the time indicated in those instructions are without authority; and you are directed to close your work in the manner therein prescribed.

Very respectfully, your obedient servant,

JEFF'N DAVIS,
Secretary of War.

Governor I. I. STEVENS.

PART II.

REPORT.

CHAPTER I.

General Instructions and Arrangements.

WASHINGTON, D. C., *June* 30, 1854.

SIR: On the 8th of April of last year I was assigned to the charge of the Northern Pacific Railroad Exploration and Survey, under the following instructions:

"WAR DEPARTMENT,
"*Washington, April* 8, 1853.

"The War Department being directed by a recent act of Congress to survey the several routes of a railroad from the Mississippi river to the Pacific ocean, it has been determined to explore and survey a route from the sources of the Mississippi river to Puget sound; and the following instructions are given in relation to it, and for the information and direction of the several branches of the service:

"1st. The exploration and survey is placed in charge of Isaac I. Stevens, governor of the Territory of Washington, to whom all officers detailed for the same will report for instructions.

"2d. The general project of the operation, subject to such modifications as circumstances may direct, is to operate from St. Paul, or some eligible point on the upper Mississippi, towards the great bend of the Missouri river, and thence on the table-land between the tributaries of the Missouri and those of the Saskatchawan to some eligible pass in the Rocky mountains. A depot will be established at Fort Union, at the mouth of the Yellowstone, and a portion of the party will rendezvous there and await the coming up of the main body. A second party will proceed at once to Puget sound, and explore the passes of the Cascade range, meeting the eastern party between that range and the Rocky mountains, as may be arranged by Governor Stevens.

"3d. As in the prosecution of this exploration and survey it will be necessary to explore the passes of the Cascade range and of the Rocky mountains from the forty-ninth parallel to the head-waters of the Missouri river, and to determine the capacity of the adjacent country to supply, and of the Columbia and Missouri rivers and their tributaries to transport, materials for the construction of the road, great attention will be given to the geography and meteorology generally of the whole intermediate region; to the seasons and character of its freshets; the quantities and continuance of its rains and snows, especially in the mountain ranges; to its geology, in arid regions keeping particularly in view the bringing of water to the surface by means of artesian wells; its botany, natural history, agricultural and mineral resources; the location, numbers, history, traditions and customs of its Indian tribes; and such other facts as shall tend to develop the character of that portion of our national domain, and supply all the facts which enter into the solution of the particular problem of a railroad.

"4th. Brevet Captain George B. McClellan, already under orders to report to Governor Stevens, is assigned to duty on this survey, according to his brevet rank.

"5th. Captain John W. T. Gardiner, first dragoons; Captain Joseph Roberts, fourth artillery; Second Lieutenant Johnson K. Duncan, third artillery; Second Lieutenant Rufus Saxton, jr., fourth artillery; Second Lieutenant Cuvier Grover, fourth artillery, and Brevet Second Lieutenant John Mullan, jr., first artillery, are assigned to duty on this survey, and will report to Governor Stevens for instructions.

"6th. In addition to Lieutenant A. J. Donelson and ten non-commissioned officers, artificers and privates of the engineer company, already under orders for the expedition, one sergeant, two corporals, one musician, and sixteen privates of company D, first dragoons, now stationed at Fort Snelling, will be placed at the disposal of Governor Stevens; and, in view of the character of the service, the officers of the company are required to select none but tried men and animals for the duty.

"7th. In the exploration of the Cascade range, the brigadier general in command of the Pacific division will assign to Captain McClellan two officers from those who may volunteer for the service, and thirty men, to be selected from the several companies stationed in the Territory of Washington, and on the Columbia river. Every facility will be given to Captain McClellan and his party in the discharge of their difficult and important duties, and much is expected from the hearty co-operation and assistance of the officers and troops stationed in the Territory.

"8th. The several administrative branches of the service will, on requisition duly approved by Governor Stevens, supply the officers, soldiers, and civil employés of the expedition, (except the scientific corps and their assistants,) with transportation, subsistence, medical stores, and arms. The Quartermaster's department will supply funds to provide means of transportation, and to pay for the hired men of the department attached to the command. The Subsistence department will supply rations, or funds for their purchase. The Ordnance department will furnish forty Colt's revolvers, forty Sharp's patent rifles, forty ordinary rifles, and a mountain piece, with the necessary ammunition, and a travelling forge. The Surgeon General's department will assign a medical officer to the command, having skill as a naturalist, provided he can be detailed without detriment to the service.

"9th. After the completion of the survey of the passes of the Rocky mountains, such portions of the officers, troops, and employés, both of the escort and of the scientific corps, as are not needed in the operation westward to the Pacific, will be despatched homeward by new routes, still further to develop the geography and resources of the country. Such of the officers and troops as are not wanted for office duty, will report to their several stations; all civil employés not necessary for a similar purpose will be discharged, and the office force will proceed to such point as may be designated by Governor Stevens, to prepare the usual reports.

"10th. After the completion of the field examinations, the expedition will rendezvous at some point in the Territory of Washington, to prepare the usual reports, sending to Washington at the earliest practicable moment a summary of the principal events of the expedition, and a railroad report, to be laid before Congress, on or before the 1st of February, to be followed at a later period by an elaborate report, presenting a full account of the labors and results of the expedition.

"11th. The sum of forty thousand dollars ($40,000) is set apart from the appropriation for the survey thus intrusted to Governor Stevens.

"JEFFERSON DAVIS,
"*Secretary of War.*"

In conformity with these instructions, I proceeded to organize the parties for the work assigned to me, took the field in person at the earliest practicable period, and have now the honor to submit the following preliminary report, showing the progress of the exploration at this time, and particularly developing the facts which have been established in reference to the practicability of the northern route for a railroad.

You have already been advised, by my previous reports, of the details of the organization of the exploration, and of its narrative and history to the present time; yet, to present the whole subject in one view, I will briefly restate the plan pursued in prosecuting the survey, and refer to the several parties employed in the exploration, and the routes examined by them. This will be done with all possible brevity; and for fuller information I will refer you to my previous communications, and will request that they be considered as forming a portion of this report.

CHAPTER II.

Field Explored by Different Parties.

As the field contemplated in my instructions extended from the great lakes to the Pacific coast, and from the 49th parallel to the emigrant route of the South Pass, and as no portion of this field had been explored since the days of Lewis and Clark, except a small portion towards the Pacific coast; as a portion of it was occupied by Indians supposed to be treacherous and hostile, and as it was in a high latitude, much abridging the season of active operations, it was determined that the exploration should be conducted in two divisions, operating respectively from the Mississippi river and Puget sound; and that a depot of provisions should be established by a third party at the St. Mary's village, at the western base of the Rocky mountains, to facilitate the winter operations of the exploration, and enable the exploring parties to continue in the field the longest practicable period; and that all the parties should be organized in a military manner for self-protection, and to force their way through whatever difficulties might be encountered.

Accordingly, Captain George B. McClellan, corps of engineers, was assigned to the charge of the western division; Lieut. Rufus Saxton, jr., to the duty of establishing a depot in the St. Mary's valley; and the eastern division was under my own personal direction. A small military force was assigned to each, and the necessary scientific corps, composed of officers of the army and civilians.

The western division was charged with the duty of exploring the passes of the Cascade mountains, from the Columbia river to the northern parallel, and of pushing eastward to meet the eastern division between the Cascade and Rocky mountains. Captain McClellan was assisted in this duty by Second Lieut. Johnson K. Duncan, third artillery, astronomer, topographer, and artist; Second Lieut. S. Mowry, third artillery, in charge of the meteorological operations; Second Lieut. H. C. Hodges, fourth infantry, quartermaster and commissary; J. F. Minter, Esq., civil engineer; George Gibbs, Esq., geologist and ethnologist; Dr. J. G. Cooper, surgeon and naturalist; A. L. Lewis, Esq., civil engineer and interpreter.

Lieut. Rufus Saxton, jr., in addition to establishing the depot at the western base of the Rocky mountains, was directed to make a reconnaissance of the country passed over by him, with the view of combining the operations of the eastern and western divisions; and he was assisted in this duty by Second Lieut. Richard Arnold, third artillery, assisted by Mr. Lyman Arnold, in charge of astronomical observations; Second Lieut. R. Macfeely, fourth infantry, in command of the escort; and D. S. Hoyt, meteorologist and topographer.

The eastern division, excluding the mention of certain officers and civilians who were on duty only for a short time, and whose cases have been brought to your notice in previous reports, consisted of Second Lieut. A. J. Donelson, corps of engineers, in command of a detachment of ten sappers and miners; Second Lieut. Cuvier Grover, fourth artillery; Second Lieut. John Mullan, fourth artillery; Doctor George Suckley, surgeon and naturalist; Isaac F. Osgood, Esq., disbursing, quartermaster's, and commissary agent; J. M. Stanley, artist; F. W. Lander and A. W. Tinkham, Esqs., civil engineers; John Lambert, Esq., topographer; George W. Stevens, Esq., astronomer, and for a portion of the route in charge of the magnetic observations, assisted by James Doty; William M. Graham, Esq., astronomer; Joseph Moffett, meteorologist; T. S.

Everett, Esq., quartermaster and commissary's clerk; Thomas Adams, assistant topographer; William M. Bixby, in charge of compass-line, and B. F. Kendall, Elwood Evans, Charles E. Evelyn, and F. H. Burr, aids. A detachment of twenty men of the first dragoons was on duty with this division, and the necessary quartermaster and survey employés.

Besides which, the services of Dr. John Evans were secured as the geologist, and those of Professor S. F. Baird as the naturalist, of the exploration.

In the execution of this plan, Lieut. Donelson, with Lieut. Mullan, Mr. Graham, and six sappers, was directed to survey the Missouri river from St. Louis to the highest point it might be reached by the steamer of the American Fur Company, to establish at Fort Union a large depot of supplies and provisions, and to carefully examine the country in the vicinity of Fort Union, from the White Earth to the Big Muddy rivers. Mr. Lander was despatched in April to the upper Mississippi, to examine the several crossings of that river, to ascertain the point which, giving a good crossing, would furnish the best connexions east with Lake Superior and the northwestern roads, and west with the probable general course of the railroad route, and to report as to the best point and line of departure of the main party. Mr. Tinkham, the associate civil engineer, was soon afterwards ordered to St. Paul with instructions to co-operate with Mr. Lander in the same duty.

The main party was ordered to rendezvous at St. Paul, and a camp near Fort Snelling, named Camp Pierce, was there established under Capt. J. W. T. Gardiner, 1st dragoons, who was assigned to the command of the escort, and acted for a short time as commissary and quartermaster, but of whose services I was afterwards deprived in consequence of the state of his health, which compelled him to ask, by the advice of the surgeon, to be relieved from duty. Here the necessary arrangements were made to prepare for moving into the interior.

Previous to leaving Washington city, I had despatched Lieut. Donelson to Montreal, to confer with Sir George Simpson, the governor of the Hudson's Bay Company, as to the assistance that might be given to our operations, and had procured from him much reliable information in relation to the route, and circular letters to all the posts instructing the officers of the company to afford every aid in their power. Guides were also sent by him to Pembina for the exploration. It was my intention to send Lieut. Beekman Du Barry, 3d artillery, to Pembina, to get these guides, and, moving north of the Miniwakan lake, to meet me between that lake and Fort Union; but on my arrival at St. Paul I became convinced that they were not needed, and I accordingly determined to dispense with them altogether.

Lieut. Du Barry was then assigned to the general charge of the observations, and was relieved from duty at his own request, on the arrival of the expedition at Lightning lake, and ordered to report to the Adjutant General.

I arrived at St. Paul on the 29th May, and made the necessary arrangements for moving forward. Mr. Lander had already made his reconnaissance of the crossings of the Mississippi river, and of the adjacent country, to determine the point of departure of the main train, and Mr. Tinkham had collected much information from Capt. Simpson, of the topographical engineers, and the explorers and guides of the country. It was determined to organize two civil engineer parties, under Messrs. Lander and Tinkham respectively; the former to mark out the general route—the latter to follow making the topographical survey and collecting the data for the detailed estimate; both to push forward in advance of the main train. Their general route was on the east bank of the Mississippi river to Sauk rapids, and thence crossing the Mississippi by the Red river trail to the general region of the Bois des Sioux.

The weather was exceedingly rainy at this time, and other difficulties occurred which delayed the movement. Adopting the plan, however, of sending forward parties and wagons in detachments, as fast as they were ready, everything was on the road by the 8th of June, and on the 12th the whole force was either at Camp Davis, on the west bank of the Mississippi river, or in advance on the Red river trail. The general plan of operations was to mark out a base line by the movement of the train, and on which were to be made the observations; and, by detached parties, to examine important land-marks and side-routes, and cover as much of the country as practicable. Such a general knowledge was thus to be gained of the country as will give the means of giving locations of roads, with approximate estimates of cost.

On reaching Pike lake, on the Red river trail, Lieutenant Grover, in command of a select party of nineteen men, was detached to examine a route to Fort Union, by Dead Colt Hillock, whilst the main party, under my own personal direction, examined a more northern route, crossing the Shayenne river twice, and passing some twenty-five miles south of the Miniwakan lake.

The trails of the two commands came together in the valley of Mouse river, and they reached Fort Union without accident of any kind—Lieutenant Grover on the 25th of July, and the main party on the 1st of August.

It is proper to mention that, in the progress of the main party, much was done in the way of reconnaissance by the civil engineer parties. Besides the usual examination on the line, Mr. Lander made a reconnaissance of the valley of the Shayenne river, between the two crossings; of a portion of the Coteau de Missouri, some twenty miles westward of the general route, and of the upper valley of Mouse river; and Mr. Tinkham, besides being in charge of the topographical survey of the route, added materially to our knowledge of the course and character of the streams by detached work.

Lieutenant Donelson had already preceded the parties operating by land, had made the survey of the Missouri to near the mouth of Milk river, and a reconnaissance of the country in the vicinity of Fort Union.

On the 9th of August the command moved from Fort Union in two parties, under the command of Lieutenants Donelson and Grover; the former to explore a route leading from the Mouse River valley under the 49th parallel, and the latter to take the route of Milk river, travelled by the wagons of the Fur Companies, and both to rendezvous at Fort Benton.

At the Big Muddy river the two commands were united under my own direction, the topographical survey of the route placed permanently in charge of Mr. Lambert, and the Milk river route pursued by the whole party till it approached within 155 miles of Fort Benton; when, leaving the main train in command of Lieutenant Donelson, I went forward with two detached parties, under Lieutenant Grover and Mr. Lander, and reached Fort Benton on the 1st of September.

Lieutenant Grover was, on the 5th, sent forward to cross the Rocky mountains, and ascertain whether Lieutenant Saxton had established a depot at St. Mary's village, and Mr. Lander was ordered to be in readiness to survey the Marias Pass.

Lieutenant Donelson reached Fort Benton on the 6th of September, and Mr. Tinkham, who by my direction had been assigned to the duty of making a general exploration between the Milk and Missouri rivers, on the 9th September.

Dr. Evans, the geologist of the exploration, reached Fort Benton on the 5th September, having made a large collection in the Mauvaises Terres, and reconnaissances of the country south of the Missouri and Yellowstone, and between the Milk and Missouri rivers. He left Fort Benton for Oregon, September 10.

Without noticing minor changes of programme, it will be sufficient to state that Lieutenant Grover met Lieutenant Saxton near the dividing ridge, and that both reached Fort Benton on the 13th September, with information of the establishment of a depot at the St. Mary's village; that Lieutenant Grover was assigned to the duty of completing the survey of the upper Missouri, and of crossing the mountain chains in winter with a dog train, to ascertain the condition of the snows; that a meteorological post was established at Fort Benton, in charge of Mr. Doty and three men; that the wagons were left in store there, and much other public property; that Lieutenant Saxton went down the Missouri with enlisted men and employés not needed to continue the survey, with orders to repair to Washington city; that the Flatheads were visited at their camps, some hundred and seventy miles south of Fort Benton, by Lieutenant Mullan, and the Blackfeet, the same distance north, by Mr. Stanley; and that the exploring parties, Lieutenant Mullan, by the Hell Gate, Lieutenant Donelson, with the engineer parties, by the Blackfoot trail, all rendezvoused at the St. Mary's village by the 30th September, except Mr. Tinkham, who reached the St. Mary's valley on the 6th of October. Mr. Lander, who had gone sixty-five miles on his way to examine the Marias Pass, on the arrival of Lieutenant Saxton, made, under the direction of Lieutenant Donelson, a reconnaissance of the Marias, Teton, Sun and Dearborn rivers, and crossed the dividing ridge of the Rocky mountains by the pass of Lewis and Clark on their return route some eight miles northwest of Cadotte's Pass, crossed by the main party, and came upon the common trail thirteen and a half miles lower down the pass; and Mr. Tinkham, before reaching the narrow defile ending in Hell Gate, examined a route from the pass to the Jocko river flowing into Clark's fork, and then came into the St. Mary's valley in Lieutenant Saxton's trail.

At St. Mary's valley I found Lieutenant Arnold in charge of that post with six men and a considerable depot of provisions. Lieutenant Saxton's route to that post was by the Dalles, Wallah-Wallah, Peluse, Cœur d'Alene prairie, Clark's fork, and Jocko river. He reached the village on the 28th of August, and started for Fort Benton with a party of eighteen men on the 2d of September. Lieutenant Macfeely, in command of twenty-six enlisted men and quartermaster employés, left that village on the 4th day of September, by the southern Nez Perces trail, for the Dalles.

Lieutenant Mullan was placed in charge, with fifteen men, of a meteorological post at the St. Mary's village, with orders to explore a route to Fort Hall, and to make all possible examinations of the mountain passes, especially as to the depth and continuance of snows; and Lieutenant Donelson was sent over the general route explored by Lieutenant Saxton, with directions to send Mr. Lander down the St. Mary's river, and meet him at Horse Plain. Mr. Tinkham was sent back over the Rocky mountains by the Marias Pass, with orders to return, by some southern pass, to the St. Mary's village, thence by the southern Nez Perces trail to Wallah-Wallah, and thence over the military road to Steilacoom and Olympia. Dr. Suckley was directed to go down the St. Mary's river, Clark's fork, and the Columbia, and to make the best exploration his means permitted.

Leaving the St. Mary's valley, opposite Hell Gate, on the 7th of October, I pushed with a small party over the Cœur d'Alene mountains, and resting my animals one day at the Cœur d'Alene mission, I pushed on to Colville, and reached that place on the 18th of October, the day of the crossing of the Columbia river at that point by Captain McClellan.

To guard against the possibility of Captain McClellan's passing the eastern division, on his way to the Rocky mountains, Lieutenant Donelson was directed to despatch Lieutenant Arnold on his second crossing of Clark's fork, by the northern trail to Colville, and orders were left at Colville, directing him to go up the Columbia river, make a general reconnaissance of the river in the vicinity of the 49th parallel, and then repair to Wallah-Wallah by the route of the left bank of the Columbia, by the Grand Coulée, and by the mouth of Snake river.

Word was sent to Lieutenant Donelson to meet the western division at a camp south of the Spokane river, and arrangements were made to complete the exploration of the Snoqualme Pass by a small party with one of the assistant engineers, Mr. Lander, and carry the line down to the harbor on the sound; to explore the route crossing the Columbia above the mouth of Snake river, and leading by its north bank to Vancouver, both parties under the charge of Captain McClellan, who was also to determine, in his way, one or two doubtful points as to the geography of the country; to explore a third route, by Lieutenant Donelson, from the Cœur d'Alene mission to Wallah-Wallah, and thence down the south bank of the Columbia river to the Dalles, and to send the animals and men not needed for those duties along the usual trail to Wallah-Wallah, under Lieutenant Hodges. On a careful inspection of the animals, made by Captain McClellan and Lieutenant Donelson, they were found to be weary and thin, and inadequate to the duty. Accordingly, the whole force was sent down the Columbia, Captain McClellan and Lieutenant Donelson with instructions to make such examinations as their opportunities permitted. The remaining operations consisted in their continuing the survey. The animals were placed in good grazing at the first three places; men not needed for office duty were discharged at Columbia barracks, and the office was established at Olympia. Mr. Lander made an excellent railroad reconnaissance of the route to Puget sound by the Columbia and Cowlitz rivers.

Captain McClellan's party, in addition to the scientific corps already mentioned, consisted of five assistants in observations, carrying instruments, &c.; two sergeants, two corporals, and twenty-four privates fourth infantry; two chief packers, three hunters and herdsmen, and twenty packers—sixty-four persons in all, besides himself.

He left Vancouver on the 24th of July, and striking the Cathlapoot'l on the 1st of August, followed up its valley four days, crossed the divide on the 5th to the south of Mount St. Helens, turned round to the south and east of Mount Adams, and reached the Wenass (a branch of the Nahchess) on the 20th August. At this point one party was sent, under Lieutenant Hodges, to Steilacoom, across by the Nahchess Pass; another, under Lieutenant Mowry, to the Dalles; a third, under Mr. Gibbs, to the mouth of the Yakima; a fourth, under Lieutenant Duncan, to the main Yakima; whilst Captain McClellan went in person to examine the Nahchess Pass.

The camp was moved to Ketetas, on the main Yakima, September 3d. From this point the main Yakima Pass was examined, and on the 19th all the detached parties, having previously rejoined the main party, moved northward, and reached the Columbia river a little below the mouth of the Pischous on the 21st, and Fort Okinakane on the 27th of September.

Subsequent to this date, the party examined the country to the Barrier river, (its several heads by small parties,) its valley to the Columbia river, that river to Fort Okinakane, and explored the whole country east of the Cascades to the Columbia river, and north to above our parallel, and crossed the river at Colville on the 18th of October.

On leaving the Yakima, September 19th, Captain McClellan's party was reduced to thirty-six men in all, including himself, by the discharge of a portion of the scientific corps and of the packers, and by sending in all the troops but one sergeant and seven privates.

Subsequent to reaching Olympia Captain McClellan had made an examination of the eastern shore of the sound to north of Snohomish river, and of that river and the Snoqualme, and of the adjacent country, for some miles above the Snoqualme Falls.

The remaining operations may be summed up briefly as follows. Lieut. Arnold, Dr. Suckley, and Mr. Tinkham have completed the explorations intrusted to them, with the single modification that Mr. Tinkham has crossed the Cascades over the Snoqualme instead of the Nahchess Pass; Lieutenant Mullan has explored the passes in the Rocky mountains from Hell Gate to Fort Hall; and Lieutenant Grover has crossed the several mountain ranges in winter, leaving Fort Benton on the 2d of January, and reaching Wallah-Wallah the 2d day of March.

I have examined, personally, the harbors on the eastern shore of the sound to Bellingham bay, the channels thence to the Straits de Fuca, and the harbors of Penn's cove, on Whitby's island, and Port Townsend, at the point where the straits join the waters of the sound.

CHAPTER III.

General Description of Region Examined, and Results Accomplished.—General Salubrity of the Region.

The country thus occupied, or to be occupied, may be described as follows: It lies between the great lakes and Puget sound, the forty-ninth parallel and the emigrant route of the South Pass. In it are four great rivers—the Mississippi and the Red river of the North, flowing into the Gulf of Mexico and Hudson's bay; the Missouri and Columbia rivers, flowing eastward and westward from the Rocky mountains in opposite directions.

There are three mountain ranges, running in a general direction north and south—the Rocky, Cœur d'Alene, and Cascade mountains. The four rivers are more than powerful auxiliaries as lines of communication in building the road and advancing settlements, affording in their course large tracts of arable and pasture land and inexhaustible supplies of lumber and stone. They have essentially modified the climate. The Mississippi and the Red river of the North, with their several tributaries interlocking each other, nearly all heavily timbered, make the eastern portion of the field one of inexhaustible fertility, and have great natural advantages for bringing supplies and productions of all kinds to market. The Missouri river has turned the formidable chain of the Black Hills and Wind River mountains, and with its southern tributaries, especially the Yellowstone, presents a rich and inviting country at the base and into the valleys of the mountains. The Columbia has found its way through the Cœur d'Alene and Cascade chains, affording excellent passes, and the tributaries of the two rivers interlocking in the Rocky mountains have broken it into spurs and valleys, affording several practicable passes, and with a tunnel admitting the passage of a road at an elevation of about five thousand feet.

In the region of the South Pass the Rocky mountain range extends from near Fort Laramie to the valley of the Salt lake, through nearly seven degrees of longitude, or a distance of about three hundred miles, at an elevation of, from 4,519 feet (Fort Laramie) to 7,400 feet (South Pass,) and from 4,222 feet (Great Salt lake) to 8,400 feet (Wahsatch mountains,) above the sea; and the whole system of ranges to the Pacific extends through seventeen degrees. Northward, none of the subsidiary spurs that branch to the eastward cross the Missouri and Yellowstone, and the main chain deflects considerably to the westward, till, in the region extending from the sources of the Missouri to the headwaters of Sun river, the system of ranges extends only through nine degrees of longitude, of which three to four degrees are occupied by the prairie region of the Great Plain of the Columbia, and in the several passes the greatest elevation is about 6,300 feet, and the length of the route where the elevation exceeds that of Fort Laramie and the Great Salt lake, is fifty-six miles. Crossing the Yellowstone and Missouri, the whole country eastward to the Mississippi is a prairie region. Puget sound is in the same longitude as San Francisco, and a railroad through the South Pass to San Francisco or Puget sound must, without making any allowance for the Great Plain of the Columbia, pass over a mountain region eight degrees in longitude greater than by the route north of the Missouri and Yellowstone.

Thus the distinctive character of the route is the great extension of the prairie region westward; the easy character and the low elevation of the passes of the Rocky mountains; the practicable character of the passes in the Cœur d'Alene and Cascade mountains, and its connexion with the great natural water communication across the continent of the Missouri and Columbia rivers.

The results thus far accomplished may be summed up as follows: The Missouri and Columbia rivers, with the exception of sixty miles of the latter, have been surveyed; three passes, including that of the Columbia river, have been explored in the Cascade and Cœur d'Alene mountains; nine passes in the Rocky mountains; two lines have been run from the Mississippi river to the base of the mountains; ranges of country south of Fort Union, and between the Yellowstone and Missouri rivers, at the eastern and western bases of the Rocky mountains from above our parallel to the forks of the Missouri, and in the Territory of Washington, between the Cascade and Cœur d'Alene mountains, have been explored. Not only has information been collected in reference to the routes for a railroad, but attentive consideration has been given to wagon roads, to the navigability of the rivers and the part they must play in establishing communications, the adaptation of the country to settlement, the Indian tribes, and the military posts that ought to be established. Additional explorations and surveys ought, however, to be made, to determine the most practicable route for the road, and, incidentally, still further to develop the geography and resources of this region of country. Before passing, however, to the consideration of these questions, I will advert to the remarkable salubrity of the whole region included in the exploration.

The reports of medical officers, Dr. Suckley and Dr. Cooper, will show the healthiness of this route. From the Mississippi to Fort Union, in a force of eighty-six men, there were slight ailments growing out of too free use of buffalo meat, and the use of saline water, good camping grounds not having been selected; but they yielded readily to treatment, only one person having been confined to his bed, and that was in consequence of his own gross imprudence. With proper choice of camping grounds, there will be no difficulty in nearly always procuring good water, and plenty of it.

This portion of the route was made from June 10th to August 1st. From Fort Union to Fort Benton, the party consisted of over one hundred persons, and the time occupied in the march was from August 8th to September 6th—distance 375 miles. Three men became sick, but in each case it was the breaking out of chronic complaints of long standing. From Fort Benton to the Great Plains of the Columbia, the route passed through a well-wooded and bountifully watered country, and there were no cases of sickness in the command.

There was, in the remaining portion of the journey, but one slight ailment; though on approaching the lower Columbia, and in the journey from Columbia barracks to Olympia, the command was exposed to frequent rains. I do not include the case of two persons whose indisposition was caused by gross negligence, and which is referred to in Dr. Suckley's report. The Indians on the route were free from epidemic diseases.

The health of the party engaged in the exploration of the Cascades was also exceedingly good. No epidemic diseases prevailed. Disorders of the digestive organs were common, but yielded readily to treatment. The great dryness of the climate, and the perfect drainage of the country, prevent the prevalence of malarious diseases. Whole tribes of the Indians have, however, been almost exterminated by the small-pox. The Indians never suffer from diseases of the digestive organs, though dry fish and berries are their invariable food. They have sore eyes, in consequence of the smoke of their badly ventilated huts, and consumption is common among them, in consequence of poor clothing and shelter, combined with the use of a scanty and innutritious quality of food. On reviewing the whole route, the unequalled and unparalleled good health of the several parties operating over an extent of country eighteen hundred miles in length appears remarkable, especially when we consider the hardships and exposure necessarily incident to such operations. Not a case of fever or ague occurred. Such a state of health can only be accounted for by the great salubrity of the country explored, and its freedom from malarious or other epidemic diseases.

CHAPTER IV.

Railroad Practicability of the Section to the base of the Mountains.—Geographical Importance of the Bois des Sioux.—Navigability of the Missouri River.

To present the geography, adaptation of the country to settlement, facilities of railroad construction, as materials, communication and physical circumstances, the route will be subdivided as follows:

1. The region from the Great lakes to the Grand Plateau of the Bois des Sioux;
2. From the Grand Plateau of the Bois des Sioux to the valley of the Mouse river;
3. From Mouse river to the plateau between the Milk and Missouri rivers;
4. The region of the Rocky and Cœur d'Alene mountains; and,
5. The Cascades.

The Grand Plateau of the Bois des Sioux and the Mouse River valley are the two keys of railroad communication from the Mississippi river westward through the Territory of Minnesota. The Bois des Sioux is a river believed to be navigable for steamers of light draught, flowing northward from Lake Traverse into the Red river of the North; and the plateau of the Bois des Sioux may be considered as extending from south of Lake Traverse to the south bend of the Red river, and from the Rabbit river, some thirty miles east of the Bois des Sioux river, to the Dead Colt Hillock. This plateau separates the rivers flowing into Hudson's bay from those flowing into the Mississippi river. The Mouse River valley, in the western portion of Minnesota, is from ten to twenty miles broad; is separated from the Missouri river by the Coteau du Missouri, some six hundred feet high, and it is about the same level as the parallel valley of the Missouri.

1. The plateau of the Bois des Sioux will be a great centre of population and communication. It connects with the valley of the Red river of the North, navigable four hundred miles for steamers of three or four feet draught, with forty-five thousand square miles of arable and timber land; and with the valley of the Minnesota, also navigable at all seasons, when not obstructed by ice, one hundred miles for steamers, and occasionally a hundred miles farther. The head of navigation of the Red river of the North is within one hundred and ten miles of the navigable portion of the Mississippi, and is distant only forty miles from the Minnesota. Eastward from these valleys to the great lakes, the country on both sides of the Mississippi is rich, and much of it heavily timbered. The great number of streams affords extraordinary facilities for bringing supplies to market. Roads can be run to the several crossings of the Mississippi from Dubuque, which affords the most direct communication with Chicago, to Little Falls, which affords the most direct communication with Lake Superior. Little Falls, indeed, is the best crossing of the whole. It is only three hundred and twenty-five feet long, and is in two channels of one hundred and twenty-five and two hundred feet. The line thence to the Bois des Sioux is better than the other lines in crossing the heads of streams and furnishing greater supplies of timber. And as the country east of the Mississippi from the Little Falls furnishes extraordinary facilities for railroad construction, and especially an excellent connexion with St. Paul, the head of navigation of the Mississippi river, the Little Falls will be adopted as the point of crossing the Mississippi. The route thence to Chicago can be either direct by St. Paul, or by Stillwater, on the St. Croix, with a branch to St. Paul.

In the location of the road, the routes to the other good crossings should be examined. The most important crossings are near the Falls of St. Anthony, at the rapids near the mouth of Sauk river, and at the several points for two miles above these rapids, at the ferry near the mouth of Swan river, and at the Little Falls.

No difficulty will be experienced in locating the road from the plateau of the Bois des Sioux to the valley of Mouse river. It should keep south of the Shayenne, the northern limit of the plateau, to avoid the severe crossing of that river, and, pursuing a course north of the Dead Colt Hillock, keep along the dividing ridge between the Shayenne river and the Rivière à Jacques. On this portion of the road there is a scarcity of timber, and for a portion of the way water must be brought in aqueducts from the lakes on the Coteau du Missouri, which may be used both in running the road and in the growth of cotton-wood on the line of the road for supplies of fuel. Timber and fuel can be brought to the plateau in great quantities from the Red river of the North, and considerable supplies can be procured from the Shayenne. Lignite coal has been found on the Mouse river, and further search may lead to the discovery of beds of bituminous coal.

3. From the valley of Mouse river the route to the plateau between the Milk and Missouri rivers must pass over the Coteau du Missouri at grades of not exceeding forty feet to the mile, and, descending into the valley of the Missouri river either by the Grand Coulée or the Big Muddy river, at grades not exceeding forty feet to the mile, can take two directions, either along the valley of the Milk river, to a point north of the Bear's Paw mountains, or, crossing the Milk river near its mouth, can pursue an intermediate course between the Milk and Missouri rivers, passing through the Bear's Paw mountains.

The second route, involving the intricacies of the Bear's Paw mountains, and not having been examined by an estimating engineer, will not be considered in this report. It will save perhaps twenty miles in distance, and should be examined previous to the location of the road.

The valley of the Milk river has extraordinary railroad facilities—in its water, its groves of cotton-wood, its materials for ballasting; and is in connexion at several points with the Missouri river, as a line of supplies and communication to Fort Union, which may be reached by a spur road at the mouth of the Big Muddy, and at the mouth of the Milk river. This will render available for the road the resources in timber and stone of the upper Missouri and Yellowstone.

From the great lakes, therefore, to the plateau at the base of the mountains, the road has several solutions, involving no higher grade than forty feet, and that for a few miles passing for the most part through a rich country, part of it heavily timbered and well watered; a deficiency of wood and water in other parts easily supplied by aqueducts, by the growth of cotton-wood, by the connexion of the Missouri and the Yellowstone, of the Red river of the North, the Shayenne and the Mouse rivers. In this connexion I will refer to the general character of the Missouri as a line of communication in the construction of the road.

The Missouri is navigable as high as the mouth of the High Wood creek, fifteen miles below the Great Falls of the Missouri, by steamers drawing eighteen to twenty inches of water at all seasons of the year, when not obstructed by ice, and for steamers drawing two and a half to three feet for one-half the season. Its principal tributary, the Yellowstone, is also navigable for steamers for two hundred miles, and still farther for keel-boats and canoes. None of the rivers of the upper Missouri are navigable, except, perhaps, the Marias, which is said to be navigable for steamers of light draught some fifty miles. There are two rises in the river, occurring in May and June, caused by the melting of the snows of the prairies and the mountains, which facilitate very much the navigation of the river. The distance from its mouth to Fort Union is 1,900 miles, and to the mouth of the High Wood creek about 2,430 miles. From the mouth of the river to the Great Bend the country admits of almost continuous settlement; thence to Fort Union, only about one-fourth could well be cultivated. Above Fort Union there are many extensive bottoms adapted to agriculture, and much arable land in the vicinity of Fort Benton, especially on the High Wood creek. The immense quantity of game along the whole course of the river to below the Great Bend, is an evidence of its goodness as a grazing country. The obstructions consist in snags, sawyers, and sand-bars, rapids, chains of rock, through which there is but one channel, and strong northwest winds. In the upper Missouri, rocks are occasionally found in the channel, brought down by the ice. To remove snags and sawyers, snag-boats should ascend the river every two or three years. In the vicinity of Fort Union, and at other points of the river, both above and below Fort Union, the channel is very narrow and tortuous.

The worst rapids are encountered above the mouth of the Muscle Shell river, and are particularly described in Lieut. Grover's report. Only at the Dauphin rapid is the current as great as four and a half miles per hour; besides which, the channel is crooked and obstructed by boulders. A rapid having but fifteen inches of water occurs five miles below Fort Benton; but from the character of the bottom, it is the opinion of Lieut. Grover that steamers of eighteen inches would make their way over it; and of Lieut. Saxton, that even a steamer drawing twenty inches would meet with no difficulty. No other rapids have twenty inches or more of water.

The stones which occur in the channel could easily be removed by providing a boat with suitable grappling-hooks, with which she can hitch on to a rock in her way and drop down with it into deeper water, with very little detention.

Above the mouth of the Platte, the river is closed by ice from the middle of November to the 1st of April. The temperature, however, is milder in ascending the Missouri, and winters frequently occur in the vicinity of Fort Benton when the river is not closed by ice more than three months.

The average time for steamers ascending the river to Fort Union has been forty-two days, and of descending eighteen days. The steamers, however, have not been of a good class, and the round trip has been made in less than fifty days, starting when the river was low, and making the trip in July and August. Above Independence, moreover, steamers never run at night, from the want of knowledge which prevails of the channel; and frequent stoppages have to be made for fuel, which in all cases has to be cut by the crew after leaving the settlements.

With first-class boats having powerful engines, and with suitable depots for fuel, three round trips per year could be made to Fort Union, and perhaps four. With the present imperfect arrangements, there is no difficulty in making two trips. It will become a most important line of communication in transporting supplies of all kinds, workmen, tools, provisions, machinery, and railroad iron, to the section which, resting on the Missouri from Fort Union to Milk river, is pushed eastward to the Mississippi, and westward to the mountains.

The upper Missouri can be made use of to transport workmen, provisions, and supplies of all kinds. From Fort Union to Fort Benton, the time occupied ought not to exceed five or six days. With the use of the navigable portions of the Marias river, it will become a vital element in the construction of the Rocky mountain section.

The Missouri river will also prove valuable as an emigrant route; but when the railroad is completed, its importance will chiefly be confined to the towns and cities on its banks. This river will, with the Yellowstone, furnish timber for the section at Fort Union.

For a more detailed description of the Missouri river, I refer you to the reports of Lieutenants Donelson, Saxton, and Grover, which will be found in the appendix. (See E No. 14, E No. 15, and E No. 16.) Lieutenants Donelson and Grover made the survey of the river, and Lieutenant Saxton went down in a keel-boat drawing eighteen inches of water at the lowest stage, and carefully considered, from the experience thus gained, the practical difficulties in the way of steamboat navigation. He has had much experience in the use of steamers in shallow rivers.

In this connexion it will not be out of place to refer to the opinions of the members of the Fur Companies who have been, and are now, in charge of posts on the Missouri—as Robert Campbell, Alexander Culbertson, Mr. Clarke, and others, who, simply from their own practical experience in the use of keel-boats, have long been satisfied as to the navigability of this river for steamers, and would not hesitate to employ them did their business warrant it; and to the experience of the Nicaragua transit route, where iron-hull stern-wheel boats are in use, drawing from thirteen to seventeen inches of water, and carrying four hundred passengers with their baggage; and of the Alleghany river, in Pennsylvania, and the Little Tombigbee, in Alabama.

Moreover, I have submitted the practical difficulties of the navigation of the Missouri, with its currents, rapids, sand-bars, and sudden deflections, to the consideration of experienced men, who have been the pioneers on these rivers, and are skilled both in the construction and the running of boats, and they are satisfied that steamers of very considerable tonnage, and carrying many passengers, can be used on this river the entire distance to the vicinity of the Falls.

The following extracts from the reports of Messrs. Lander and Tinkham, giving the results of personal examinations between the headwaters of the Mississippi and the Rocky mountains, are here given as highly descriptive of the characteristic features of this portion of the route.

1. *Extracts from Mr. Lander's report of February 15th*, 1854.—The road from Bois des Sioux to the head of the Coteau du Missouri should pass north of the Coteau des Prairies, near Dead Colt Hillock, along the dividing ridge between the Jacques and Shayenne rivers to the headwaters of the Jacques, and avoid the bad crossings of the Shayenne river, which occur on the line of the odometer survey. There is a scarcity of timber upon the route; but lignite coal is found in quantity in the valley of the Mouse river, and, by the use of proper blast in furnaces, may become of service. Cotton-wood occurs in the valley of the Shayenne, although it is not abundant. The soil upon the line is fertile; groves of timber can be readily grown during the period required for grading the road. Sufficient stone for culvert masonry can be found among the boulders upon the hill-sides in the vicinity of the Shayenne river, and the line will pass sufficiently near the Shayenne to secure the advantages to be derived from its valley, either in pasturage, timber, or stone for culvert masonry. Twenty miles west of the "Maison du Chien" occur ledges of sandstone, from which excellent materials for masonry may be furnished for long sections of the road. At the headwaters of the Shayenne, and at the Dead Colt Hillock and "Lightning's Nest," fine material for ballasting may be found—a fact of much importance to this division of the road, which, passing over low prairie country and in cutting through a pebbly limestone gravel mixed with clay, will need ballasting throughout. The portion extending through the salt-water region will need particular attention, regarding a supply of pure water for the use of engines. The proper mode of overcoming this difficulty will be, by extending an aqueduct along the line of the road from the lakes upon the Grand Coteau du Missouri.

As the line will skirt the northern extremity of the Grand Coteau, the location of this work will not be difficult. Good brick-clay is found near the Maison du Chien, and the upland lakes of that vicinity are of sufficient height above the grade of the road to afford the requisite facility. I recommend a descent from the head of the Grand Coteau to the valley of Milk river by the Grand Coulée. It would by a spur road easily connect with Fort Union. From the Big Muddy the line would pass to the valley of Milk river, through which it continues for a long distance to a point of departure north of Bear's Paw mountain, and thence along the north bank of the Marias to the great valley of the Dry Branch; then crossing the Marias, makes ascent through the valley of the Dry Branch in a southwesterly direction towards the grand approaches of Lewis and Clark's Pass of the Rocky mountains, crossing the headwaters of Teton, Sun, and Beaver rivers. Grizzly Bear lake, lying between the headwaters of the Sun and Beaver rivers, can be formed into an unfailing reservoir for supplying the line, by the erection of a dam at its lower extremity, and by turning the water of a small mountain stream into the lake.

The line passes near Grizzly Bear lake, and for several miles the grade is a gentle descent towards the Marias river.

By the use of the yellow mountain pine, abundant in the vicinity, a line of logs could be laid along the route, and furnish water to the road for the supply of the engines and the employés—the temporary structure eventually superseded by proper iron castings or brickwork. Good brick-clay is found in quantity near Grizzly Bear lake.

All difficulties of construction may be overcome upon this important division at reasonable cost. The great valley of Milk river affords remarkable facilities for construction, as regards grading and the immediate use of the rail. Vicinity to the Missouri aids transportation of timber from the mountains by rafting.

An embankment road-bed must be resorted to in the valley of Milk river, to guard against rise of water upon the bottom land over which the line will pass.

2. *Extracts from Mr. Tinkham's report.*—From the Mississippi a vast prairie stretches westward to the base of the Rocky mountains, 1,136 miles; and a breadth of 402 miles of wooded and mountain country lies between the prairies and the great Columbia river plains. These prairies reach down to the bottom lands of the Columbia, whose valley, including that of its tributary, the Cowlitz, is traced to the shores of Puget sound—a third portion of 507 miles. These are the measured distances of the railway route hereafter defined, and are changed by adopting for portions of the line other practicable or probably practicable routes.

From the Mississippi to the bottom levels of the Missouri are certain prominent and unusual features, the knowledge of which is of great service in directing the location of the line of railway, the easiest and cheapest line between the headwaters of the Mississippi and the great northern bend which the Missouri makes near the mouth of the Yellowstone. It may nevertheless be observed, with reference to the region lying between the Mississippi and Missouri, that so far destitute is it of serious obstacles, that the great selection of a railway route uniting the two rivers may be determined by the commercial relation rather than by the physical features of the country traversed.

The section of Minnesota east of the Mississippi, passed over by the exploration, presents few difficulties to the building of a railroad. Obstructed by no mountain ranges, and diversified by lightly-wooded lands, the fertile belt of prairie bordering on the river affords a good location. Farther interior, on the east, and to the north and northwest, are the wooded and lumber sections.

Bordering on the Missouri, and running parallel with it, is the Plateau du Coteau du Missouri—a high rolling plateau, having an average breadth of some 60 to 80 miles, rising from 400 to 800 feet above the bed of the river. This plateau, remarkable for its uniformity and extent from below the latitude 44°, stretches north and west into the British possessions, and probably here retains its characteristic features as the dividing ridge between the waters of the Sascatchawan and the Missouri, until absorbed in the bolder elevations of the eastern slope of the Rocky mountains.

The passage of the plateau by a railway will by no means be impracticable with a careful selection of route; but it can rarely be done without a loss of grade greater than 400 feet.

East of the plateau and parallel with it, at distances of from 20 to 50 miles from its eastern edge, flows Rivière à Jacques, or James river, finding its source near the headwaters of the Shayenne, and having with that river, for some 100 miles, nearly the same general southeasterly course.

The general surface of the high plains through which these two streams find their descent—the one to the Red river of the North, the other to discharge its waters into the Missouri—is here 400 to 600 feet lower than the plateau. Of this summit-ground, distributing and dividing the waters to their northern or southern slopes, the extensive flat or prairie through which flows the Bois des Sioux river is the eastern limit. The connexion between this prairie and the Mississippi is along the sources of the tributaries to the Minnesota river. Crossing these streams in their infancy, and before the crossing of the several valleys, is objectionable.

Carrying the line northwardly to the great bend of the Missouri, we avoid a difficult and objectionable river-crossing, and, what is of more importance, head what is represented as the extensive, broken, and tumultuous region of country south and west of the Missouri and extending to the Platte, and known as the Black Hills.

The railroad route from St. Paul keeps up the left bank of the Mississippi, crosses at Little

Falls, continues along the dividing ridge between the Mississippi, Red river, and the Minnesota, until entering upon the prairie of the Bois des Sioux, pursues its same general direction through this prairie, passes thence on to the summit-grounds between the James and Shayenne rivers, and finally, without losing its elevation, enters and passes the great plateau of the Missouri by a coulée connecting the two valleys of the Mouse and Missouri rivers, and for a time piercing the barrier which separates them.

Proceeding up the Missouri from the mouth of the Great Muddy river to the entering of Milk river, the railroad line for nearly 180 miles follows the favorable valley of this latter stream; then, leaving it, passes on to the prairies, and so continues until within a few miles of the mountain pass, crossing in succession Marias, Teton, and Sun rivers, with the tributaries of Dearborn river.

CHAPTER V.

Details of Excavations and Embankments.—Supplies of Wood, Water, Stone, and other materials.

To go over the (railroad) line, as shown on the map, more carefully, and in sufficient detail to give its general features.

The Mississippi at St. Paul flows some one hundred and fifty feet below the high prairies in the rear of the town. The connexion between the Mississippi and the higher ground is made with a forty-foot grade. With but little variation of surface or soil the line follows the general direction of the river, passing over prairies or oak uplands, to Sauk rapids, and thence to Little Falls, one hundred and twelve miles. In this interval the soil generally consists of a vegetable mould of from one to four feet depth, resting on a gravelly or sandy substratum, affording the best material for a firm and dry road embankment. On the right, and farther interior, is the heavily wooded and timber country of Minnesota, the tamarac swamps occasionally approaching the line. No rock cutting was observed, though rock was found in place near St. Anthony's Falls, and in the vicinity of Sauk rapids.

The grades along the east bank of the Mississippi are light, seldom exceeding ten feet per mile. The bridge crossings are, Rice creek, sixty feet; Coon creek, sixty feet; Rum river, one hundred and fifty feet; Elk river, one hundred and twenty feet.

The culvert masonry is small, and the earth-work will not exceed an average embankment of six feet. For structures, both of wood and stone, the material is good and near at hand. Of lumber, the yellow and white pines, larch and cedar, are abundantly manufactured on the St. Croix and the different tributaries of the Mississippi, and with these woods the white, black, and bur oaks, ash and sugar maple. All of these different species of lumber are manufactured near the line of the road. Granite was found in place near Sauk rapids. An inferior limestone is obtained in the vicinity of St. Anthony and St. Paul, but it is probable that for the present, lime must be obtained from a point lower down on the Mississippi.

The crossing at Little Falls requires but three hundred and twenty-five feet of bridge, in two stretches, the river being divided by an island. The river is crossed at right-angles. The abutment rests on rock. Crossing at the falls, the bridge presents no obstruction to navigation.

The crossing at Little Falls affords a good connexion with a line from Lake Superior, and enters, on the west shore, a better wooded country than will be obtained by going further south, and over which it will probably be practicable to build a firmer and drier road-bed.

The crossings at St. Anthony Falls and the Sauk rapids are eight hundred feet and six hundred feet respectively, both feasible and giving fair facilities.

In the next hundred and twenty-eight miles, to the Bois des Sioux prairie, the line passes successively through a wooded and prairie country, and thenceforward to the Rocky mountains the growth of wood is confined to the bottoms of rivers and the borders of lakes.

The rise in this interval is about three hundred feet. The ground is rolling, sometimes showing stony and gravelly knolls, and is frequently interrupted by small lakes.

The earth-work for this hundred and twenty-eight miles will not exceed an average embankment of eight feet height, and is occasionally stony. Granite boulders, at occasional intervals, are scattered on the surface. Side ditching is often necessary in flat and low places, but for the main part of the distance the excavation is light and gravelly. There is no rock excavation.

Grades of thirty feet per mile will occasionally be required in the limited region of knolly, rolling country, but will generally not exceed ten feet.

Crossing the tributaries of the Minnesota at their sources, the amount of bridge work will be small; an estimate of two hundred feet on the small streams of the Crow, South Branch, and Chippewa rivers, covers the whole. The culverts will be small and frequent in number.

The pine and wooded region through which the line passes is estimated to extend westward from the Mississippi eighty miles. The numerous beautiful lakes are often surrounded with a handsome growth of wood, mainly elm and poplar. The supplies of lumber will, however, be drawn mostly from the Mississippi and the pine region to the west of it, and with small expense of transportation.

Stone is found in places only at the Mississippi. The granite boulders are found at some sixty miles west of the Mississippi, and will supply the culvert masonry. Stone for the small amount of bridge abutments must be brought from the Mississippi, unless further explorations discover the formation of good building material.

Thenceforward to the valley of the Missouri the total rise is about 700 feet. In this portion is included the prairie of the Bois des Sioux, a remarkable flat of some forty miles width, almost an absolute plain, and from whose eastern verge the eye seeks in vain, on its shadowy, monotonous surface of coarse, dark grass, any relieving undulation, or tree or shrub. Through this remarkable prairie the Bois des Sioux and Wild Rice rivers make their way to join the Red river of the North, in narrow, canal-like channels, with miry sides and bottoms. The elm and oak are found on these two streams, either threading their banks or grouped together in handsome clusters. The water-level was, in the latter part of June, when crossed by our train, some eighteen feet below the edges of the banks, but high deposits of drift stuff had been made on the banks, and were found even at several miles distance from the river. In the breaking up of winter, and with the spring rains, this prairie is undoubtedly very wet and marshy, and, to a great extent, covered with standing water, though at small depth.

Between this prairie and the Shayenne the land becomes undulating and dry; and, in the vicinity of that river, sand-hillocks, and in some instances sand-bluffs, show themselves. The Shayenne flows in a deep valley, 150 to 200 feet below the general prairie level, and with a valley one-quarter to three-quarters of a mile wide. The bottom is fairly wooded with elm, oak, ash, poplar, &c. At the first crossing made of this river by the train, its width was sixty feet, its depth fourteen feet, with freshet marks eighteen feet above the water-level. At the second crossing its width was fifty feet, its depth three and a half feet, the immediate banks miry in both cases. These crossings would be expensive and cause much loss of grade, and are avoided in the direction given to the route. Granite boulders of large size are frequent on the high grounds bordering on the river, and at one place east of the second crossing it was supposed that granite was found in place.

From the bend of the Shayenne to Mouse river the country is nearly uniform, gradually rising, is in part undulating, but has many small lakes, and is often marshy. Rivière à Jacques is crossed with a width of some 120 feet. This river has probably very little wood on it within reach of the route.

There is a general destitution of wood throughout this interval, and it is only rarely that one finds a growth of wood on the numerous small lakes, and the small tributaries of the James river. The vegetable mould, not over-deep at Shayenne river, gradually decreases, and the soil is generally thin at the source of the Shayenne and James rivers. Thence the soil improves until we reach the Mouse river, where there is much good arable land.

The Shayenne river, with a curve from the north, appears to retain its character, as already observed, with a deep valley, high, steep banks, wooded bottom, and much the same formation of clay and sand, intermixed with gravel and pebbles, as lower down. It is probably wooded as far as Miniwakan lake, and at the final crossing by the train near the source of one of its forks, was even then noticeable for its deep valley and steep banks.

Mouse river is a large stream of water, and, after the Red river of the North, is the most important river on the route between the Mississippi and Missouri. It flows in a deep, wide valley, upwards of 200 feet below the prairie level, with a width of bottom varying from a half to two miles; is wooded, and sometimes heavily wooded, with a growth of elm, oak, ash, and probably with other woods. Its high and steep banks, of about the same formation as belongs to the Shayenne, are cut by deep coulées, extending back from the river ten and fifteen miles, having generally a fertile soil and scattered trees. These coulées are difficult of passage with wagons, and the construction of a railroad across them would be attended with heavy embankments and culvert masonry, and with great expense. The location of the line has been so chosen as to head them. At Mouse river a coarse, gray sandstone crops out, and may furnish some fair building-stone. Near by, at the Butte Maison de Chien, examined by Mr. Lander, he reports an abundance of excellent sandstone for building.

Mouse river is about 120 feet wide, and was, apparently, as much as seven feet deep, and is navigable for a long distance, and possibly quite to Red river. The information obtained in regard to it was, from one source, that no obstruction to its navigation existed as far down as its mouth; from another source, that there was one intervening rapid. Its navigability would be of service in transporting materials, and its valley, with many fertile and pleasing locations, offers greater inducements for settlement than are to be found for a long distance on either side of it.

The interval remaining to the high plateau hiding the valley occupied by the railroad from the Missouri, is by the River of the Lakes, a tributary of Mouse river—small, but possessing in its deep, wide valley and coulées much of the same character. It is wooded for only a small extent.

From the head of the River of the Lakes, a favoring and singular coulée breaks the Plateau du Coteau du Missouri, and, with a grade not exceeding forty feet per mile, the line passes through to the bottom lands of the Missouri.

From the commencement of the Bois des Sioux prairie to Missouri river, the earth-work would not be heavy, nor of an expensive nature. An average embankment of seven feet would cover the earth-work. The excavation of the Bois des Sioux prairie is easy, approaching and bordering on the Shayenne; boulders and stones are often mingled with the soil, adding to the expense of removal; and this last character of formation is, at intervals, met with all along the line, while, in general, the substratum appears to be a clayey loam.

Of rock excavation there is none. Except in crossing the divide, grades need not exceed thirty feet per mile, and will rarely be so great.

The Bois des Sioux will require a bridge of 140 feet; the Wild Rice river 120 feet; a small stream near Wild Rice river should be spanned by a hundred-foot truss, and James river will require 120 feet of bridge.

The culvert masonry will be small in amount; but care should be taken in side-ditching, and the prairie embankment should always be as high as four feet, both to obtain a dry and firm road-bed, and for the disposal of the winter snows.

Wood will be scantily furnished from the route of the road for its construction. The Bois des Sioux and Wild Rice rivers will furnish a small amount. The Shayenne will furnish sleepers for 200 miles of the way, single rail. We do not know that James river will furnish any. Wooded lakes occasionally aid in the supply. Mouse river is liberally wooded, and I think may be depended upon to furnish 200 miles with sleepers. The connexion with the Mississippi and Red rivers at one end, and with the Missouri at the other, will make up any deficiency in the superstructure; but the Missouri bottoms furnish little but the sweet cotton-wood, a soft, porous and inferior wood, and not to be used when other can be obtained at a reasonable expense.

The red cedar, in small quantities, grows both above and below Fort Union. A good deal of valuable white oak can be obtained from Red river. From all these sources I estimate that the road can be fitted with its superstructure, and with good materials, and be supplied with fuel for at least six years' running time, full operation, and from its various connexions could indefinitely extend this period, but with considerable expense for transportation. Coal, according to Dr. Owen, exists in the lower part of Minnesota and in Iowa; and while our exploration has ascertained the existence of an inferior coal in Mouse River valley, the information obtained there makes it probable that a better coal is to be found in that region.

Stone for masonry is also scarce, and but little is needed. The frequency of the granite boulders will be of service in the building of culverts, and to some degree may aid in constructing the small amount of bridge abutments. Building-stone in abundance can be obtained from near the Butte Maison de Chien, and possibly the sandstone of Mouse river will be found of value.

At Mouse, Shayenne, Bois des Sioux, and Wild Rice rivers, but with better facility at Red river, all the materials for good bricks are obtained, and it may be found cheaper and better to use brick masonry in the neighboring bridge and culvert works.

Water can, by reservoirs and unimportant aqueducts, be introduced at any point of the line required. The numerous small lakes extending along the greater part of the distance will, in this way, be of service.

A little east from the second crossing of the Shayenne were observed the first indications of approach to the "salt-water region." Throughout this region, extending from this point to the Mouse River valley, small ponds and lakes are to be found, (brackish and slightly salt) and frequently with white salt incrustations of small amount on their borders. More abundant than these salt-water lakes, and constantly intermixed with them, are the small fresh-water ponds and lakes, occurring quite as often as is desirable either for travelling or railroad purposes. With this abundant supply no unusual construction or expense will be required in establishing watering-places. With noon and night halts at intervals averaging less than ten miles distance, there was never a deficiency of fresh-water.

Prairie fires should be provided against by side-ditching. The grass is not tall and heavy, and with proper provision no injury to the wood need be anticipated from this source.

Proceeding up the Missouri, from the mouth of the Great Muddy river to the entrance of Milk river, the railroad line, for near 180 miles, follows up the favorable valley of this latter stream; then leaving it, passes on to the prairies, and so continues until within a few miles of the mountain pass; crossing in succession Marias, Teton, and Sun rivers, with the tributaries of Dearborn river. The route considered enters the mountains by the pass which, in our survey, has been termed Lewis and Clark's Pass; the more northern of the two opening into the valley of Blackfoot river, or by "Cadotte's Pass"—a second entrance into that valley.

Missouri river is, in the vicinity of Fort Union, some four hundred and fifty yards wide, and, so far as followed by the route, has a wide bottom of from two to eight miles across. The river is well wooded with the sweet cotton-wood, and has a small quantity of red cedar. On the south side rise the Mauvaises Terres hills, making up to some three hundred to five hundred feet height, whose name well defines their character—bare, and broken into every irregularity, washed with gulleys and ravines, and yet whose silvery glistening front, with its blended light and shade, is often a landscape feature of wonderful beauty. On the north side, also, the bluffs generally rise abruptly, and a few miles back of the river the plains attain an elevation above it of from one hundred to three hundred feet. A coarse soft sandstone crops out often in the edge of the bluffs, and apparently underlies the whole surface extending to the upper Missouri above Fort Benton. The bottom-lands are almost flat, descending slightly towards the river. The Missouri has probably but a small fall—a fall which, according to the barometric observations, does not exceed one foot per mile.

By the various windings of the route, Milk river enters the Missouri some one hundred and twenty miles above Fort Union, and the line traces its course for some one hundred and eighty miles. Comparatively a small stream, it yet shows much the same features as the Missouri; has a wide, open intervale, half to four miles wide; is closed in on either side by the bluffs terminating the plains, which ascend as they recede from the river, the bluffs being very frequently cut with deep coulées, which can be traced five, ten, or fifteen miles into the interior. The river is plentifully supplied with cotton-wood, and its bottom-lands are flat and generally wide. At the first crossing of this river by the train, some fifty miles above its mouth, the bed of the stream had a width of two hundred and twenty-five feet; the running water was but fifty feet wide and two and a half feet deep, with a sandy bottom, and banks of clay and sand rising some fifteen feet above the water-level, unstable, and often displaced by the river in its annual floods. At the third crossing, by the winding of the wagon road, a little more than one hundred and eighty miles above its mouth, the river retained nearly the same width of bed and general features, but with no running stream, the water remaining in the depressions and holes in its bed.

The bottom-lands, both of the Missouri and Milk rivers, are composed of clay and sand, of a nature to become soft and sloppy with the wet of spring, and on the dry season succeeding, becoming parched and cracked. The prairie and upland formations are remarkably undeviating in their character, consisting of a mixture of clay and sand, intermixed with smooth pebbles, extending below the surface only from one to three feet, and below all, the underlying coarse sandstone The clay washed by the rains finds its way into the coulées and the bottom of the river, leaving the exposed pebbles on the surface, deceiving one with the appearance of gravelly or stony knolls. This section does not offer the best, but will afford a fair material for road embankment.

The tributary rivers on the north side for which bridges must be erected are Great Muddy river, Poplar river, and Porcupine river—all small streams, with an average width of sixty feet, and greatest depth three feet, at our several crossings.

The Missouri and Milk river bottoms possess one peculiar feature, for which provision must be made in constructing a railroad. At short intervals, averaging not over eight miles for the whole river line, narrow canal-like channels are found generally extending from the coulées of the bluffs, for the greater part dry in summer, but in spring freshets are the sluices by which the water from the rain and snow finds its passage to the river. These channels or sloughs have an average width of twenty-five feet, with a depth of eight feet, and should be spanned with a simple timber structure to prevent the accumulation of water and injury to the road-bed.

The high prairie plateau which the road attains on leaving Milk river reaches to the base of the Rocky mountains, and is marked with but little variation of surface. The same formation of clay and sand, with more or less admixture of pebbles, continues as on the prairies, running back from the Missouri and Milk rivers. There is a scarcity of wood and water. The soil at first possesses little fertility, scantily shaded with a short thin grass; gradually improving as the approach is made to the mountains. Through this plateau the rivers Marias and Teton flow in deep channels, concealed from sight till one is close upon them, with bottoms fairly wooded with cotton-wood one-quarter to half a mile wide, and marked by the deep coulées intersecting their valleys. These two rivers, in the vicinity of the railroad line, are about two hundred and one hundred and twenty feet wide, and flow some two hundred feet below the general level of the prairie. The water is no longer muddy or milky, as in the Missouri, with its lower tributaries, but is clear and cool, flowing over a pebbly and sandy bottom. The passage of the Marias river is one of some difficulty and expense, owing to the depth of the river below the prairie. The Teton is crossed high up, and with less difficulty. Sun river is crossed near its source, and with ease.

From the Great Muddy river to the base of the Rocky mountains there is a river line for two hundred and sixty-five miles, and the balance is of prairie. The earth-work in all this extent will not be heavy. An average embankment of eight feet will more than cover it. The material, as already stated, is a mixture of clay and sand, not a light loam, but easily broken up with the plough or pick, exposing a smooth and steep surface where undermined by brooks, and sliding at a steep angle.

It is not known that any rock excavation will be necessary. Occasionally a spur of coarse gray sandstone, in broken detached masses, shoots across the line from the river bluffs, but generally not without the opportunity of turning it. Two miles of side-cut rock excavation will cover this item.

The grades and curves are probably unequalled by any existing railroad of the same extent. On the river-bottoms there will rarely be occasion to exceed the rise of the rivers, by observation there being, for the Missouri about one foot to the mile, and for Milk river three feet to the mile. The rise from Milk river to the plains is made with a grade of thirty-five feet to the mile. The coulées making down to Marias and Teton rivers, affords opportunity for crossing these streams with grades not exceeding forty feet per mile.

No stream in this section is so large as to require more than a single span of bridge truss. Timber trusses will undoubtedly be found cheapest and best in every case. Great Muddy river, Poplar and Porcupine rivers, will each require eighty-feet trusses, with two abutments. Milk river is crossed in a bend of the stream, at right-angles to the current, is spanned with a truss of about two hundred and forty feet, and has an abutment twenty feet high above the river-bottom. The masonry of this bridge should be protected, by piling, from the wash of the freshets. Marias and Teton rivers will respectively require trusses of about two hundred and twenty and one hundred and sixty feet length.

The numerous small waterways required on the bottoms of the Missouri and Milk rivers have already been noticed in sufficient detail; as they carry little or no drift-ice and wood, it is not necessary to clear their highest water-line more than six feet.

The supplies of wood accessible are the cotton-woods of Missouri and Milk rivers, the wooded mountain termed the "Trois Buttes," about sixty miles north of the line, the mountains to the south of the Missouri, near Fort Benton, and the Rocky mountains at the end of the section.

The "black growth" of the streams of the Yellowstone becomes, too, tributary to this section at the confluence of this river with the Missouri, near Fort Union, and may be serviceable.

Of cotton-wood there is an abundance. In certain situations this wood is durable and useful in building, but, as a railroad sleeper, would soon decay; and being, moreover, soft, would not firmly retain the spikes and chains with which the rail is secured. The stockade at Fort Union is of cotton-wood, does not rest on the ground, and although erected some twenty or more years ago, is firm and sound. A small quantity of red cedar grows on the Missouri, and to some small extent will be available in building. The "Trois Buttes" above are capable of supplying three hundred miles of sleepers, single rail, and probably more if necessary. These Buttes rise about 3,300 feet above the prairies at their base, and with their wood and stone are a natural storehouse of materials. They are wooded for about half the extent, mainly with spruce and a kind of yellow pine, the trees being small, from eight inches to two feet in diameter, and growing straight and thickly clustered together. From the base of these mountains a smooth dry prairie extends to the route of the railway; and with but little preparation of grading, rails could be laid to bring this store of wood to the line of the road. The Rocky mountains afford an abundance of excellent wood, generally the yellow pine. On the whole this portion of the route may be looked upon as capable of supplying sufficient wood, both as fuel and building material, for present and future use.

The *lignite* of this region, traced from the coulées of Mouse river to the headwaters of Milk river, (a distance of five hundred miles) apparently underlying the whole extensive district of this country, with a thickness of bed varying from a few inches to six feet, is a source of fuel not to be overlooked. The wooded lands, with proper management and a care for future wants, I judge, will of themselves furnish the amount of fuel needed; but our present estimates as to the business of a railroad traversing this route, and the wants of settlements growing up from the establishment of the road, may differ very widely from the truth, and it is not unwise to take into consideration this inferior but extensive layer of coal, the working of which may at some time become desirable and profitable.

A coarse but generally weak and useless sandstone extends throughout the Missouri and Milk rivers. In some places a firm sandstone, suitable for building, is to be found. Sandstone of this character was noticed near Fort Union, near the last crossing of Milk river, and it is to be obtained in abundance at the "Trois Buttes," on the eastern base. Several other stones compose these mountains, the most valuable of which is a beautiful marble, at times having an alabaster whiteness and clearness.

Lime is to be obtained from near Fort Benton, from the "Trois Buttes," and from the Rocky mountains.

Sand, though in a clean state not abundant, is to be found in the beds of the rivers, and occasionally at other places in limited quantities.

Good materials for brick are furnished on the Missouri and Milk rivers.

Throughout the dry summer and fall season most of the small tributaries making into Missouri and Milk rivers are dried up, and both in the intervale and on the prairie there is a scarcity of water. The high plateau making back from these rivers affords, however, the opportunity of securing the necessary supplies by reservoirs; and protected from evaporation, there is no reason to doubt that water for the uses of a railroad can be supplied as conveniently here as on the States' roads.

For much valuable information in reference to the country east of the mountains, I will refer you to Mr. Lander's report of the crossings of the Mississippi, D No. 11; Lieutenant Grover's report of the Dead Colt Hillock line, D No. 10; Lieutenant Donelson's report of the country between the White Earth and Big Muddy rivers, E No. 14; Mr. Tinkham's report of his reconnaissance of the Three Buttes and the country between the Milk and Marias rivers, D No. 12; and Doctor Evans's report of his route south of the Missouri, and between the Milk and Missouri rivers, D No. 13. I am particularly indebted to the perseverance and skill of Messrs. Lander and Tinkham for much of the valuable statistical information given in this chapter.

CHAPTER VI.

Railroad Practicability of the Rocky and Cœur d'Alene Mountains.—Description of the ranges and of the several passes.

In determining the route through the Rocky mountains, regard must be had to the difficulties of approach as well as to the difficulties in the pass itself. Before considering the question, it will first be necessary to show the route through the Cœur d'Alene mountains.

The Cœur d'Alene mountains may be regarded as extending from Snake river to Clark's fork, and as covering from two to three degrees of longitude. Clark's fork separating it from a range still farther north, called the Kootenaies mountains, has its source in the Rocky mountains in two principal branches—one flowing from the south, called the Bitter Root river, and the other flowing from the north, and called the Flathead river. These rivers separate the Cœur d'Alene and Kootenaies mountains from the Rocky mountains, and—with the exception of a mountain spur running down towards their point of junction, giving, however, a good pass from the one valley to the other—they form a continuous valley extending along the western base of the Rocky mountains from 45° 30′ of N. latitude to far north into British territory. To the south, however, at the headwaters of the Bitter Root, of the Snake, and the three forks of the Missouri, the Cœur d'Alene unites with the main chain of the Rocky mountains.

There are at least four passes in the Cœur d'Alene mountains, well known to the aborigines: the pass of Clark's fork, the Cœur d'Alene pass by the Cœur d'Alene mission, the northern Nez Perces trail, and the southern Nez Perces trail. The northern Nez Perces trail is the route of Lewis and Clark, and was not examined. The three other passes have been carefully examined by me. There is said, however, to be a fifth trail between the Cœur d'Alene and northern Nez Perces trails, more practicable for wagons than any of the others. This has been explored by Lieutenant Mullan, but his report has not been received.

The southern Nez Perces trail leads from the southwest fork of the St. Mary's river, connecting, by a tolerably direct route, St. Mary's valley with Wallah-Wallah. For 120 miles it passes over wooded mountains, dropping at times into valleys, and, crossing them, ascends the spurs and hills again. Its elevation rarely if ever falls so low as 3,000 feet, and sometimes reaches as high as 8,000 feet—an estimate, the barometer having been cached at the height of 7,250 feet. In the month of December, when, with considerable detention and difficulty, Mr. Tinkham crossed the mountains on snow-shoes, the snow was generally about three feet deep, sometimes six feet, and in a single instance, as near as could be ascertained, ten feet deep. The average depth of the snow for the whole 120 miles was a little less than two feet. Tributaries of the Koos-koos-kia head near the sources of the southwest fork of the St. Mary's river, and offer the only possible chance of getting through the Bitter Root mountain. This direction is by the Koos-koos-kia. A tunnel will be required at the divide separating the two streams. The Koos-koos-kia was crossed near its head, at an elevation of 3,760 feet; its valley in this place is narrow and dark, with steep, rocky and wooded hills enclosing it. It has the same character where it unites with the Clearwater river after leaving the mountain. Between these two points the river has not been examined. The northern Nez Perces trail is very much of the same character, and does not come into competition for a route. The Cœur d'Alene Pass may be briefly described as a pass formed by two streams flowing in opposite directions from two lakes almost half a mile apart. The western lake is about 700 feet above the eastern. The two valleys, though narrow and somewhat tortuous, will admit, however, of a railroad at a practicable grade—the eastern one to within from two and a half to three and a half miles of the lake whence the stream has its source; the western valley three and a half to four and a half miles from its lake. These two points are six to eight miles apart, and differ in level some 300 to 500 feet. Between them the valleys rise rapidly, attaining at the two lakes an elevation respectively of 2,000 and 1,300 feet above the western, and 1,500 and 800 above the eastern base. Thus a tunnel having an inclination of 37.5 to 83.3 feet, and six to eight miles long, is the essential condition to a road by this route.

The route by the Cœur d'Alene mission is exceedingly direct, both in its own course and in its connexion with the Blackfoot and Hell Gate trails. If practicable, it would abridge distance about seventy miles, equivalent to the cost of a tunnel of about the probable length of the tunnel required on the Cœur d'Alene route. The cost of the tunnel, supposing it to be seven miles long, would be about $5,000,000. It is in limestone entirely, and easily worked. The saving in the length of the road would be, say 70 miles, at $70,000, or in round numbers $5,000,000. It was unfortunate that a barometrical profile could not be taken on this route in consequence of the want of instruments; but Mr. Stanley, an excellent judge of distances and heights, made estimates which I am satisfied, from my own personal observation, will prove good approximations. There is a good wagon-road from the mission to Wallah-Wallah, indicated on the map, and it is believed no difficulty would exist in connecting this route, south of the Cœur d'Alene lake, either with the Columbia river or Snoqualme Pass route.

The valley of Clark's fork, however, affords an excellent railroad line presenting no special obstacles; and the question now is, to determine which pass of the Rocky mountains shall be made use of in passing from the plateau between the Milk and Missouri rivers to Clark's fork.

Nine passes have been explored in the Rocky mountains, beginning twenty or thirty miles below the 49th parallel, and extending southwardly three hundred and four miles in latitude, to the most southern pass explored at the source of Jefferson fork. From this pass to Fort Hall, the extreme southern limit of the exploration, the distance in latitude is eighty miles. The northern pass, termed the Marias Pass, where a tributary of Clark's fork has its spring near the source of the Marias river—elevation 7,669 feet; a pass at the head of Beaver creek on the east, and a tributary of Blackfoot fork on the west—elevation 6,323 feet: this is the pass of Lewis and Clark; Cadotte's Pass, named from one of our hunters, who used the pass some two years since, forming the headwaters of Dearborn river and Blackfoot fork, 6,044 feet high; a pass at the head of the north branch of the Little Blackfoot fork on the west, and a stream making into the Missouri on the east—elevation 6,283 feet; a pass at the south branch of the Little Blackfoot river; a pass at the head of the Hell Gate river; one from the East fork of the St. Mary's river to the Wisdom fork of Jefferson river; and, finally, a pass from the East fork of St. Mary's or Bitter Root river to the Wisdom fork of Jefferson river.

Marias Pass, the extreme northerly one of all, is the passage over the mountains by a tributary of Marias river on the east, and of Flathead river on the west, the wooded valley of which leads down to the open, wide valley, where is Flathead lake. The branch of Marias river is a mere brook where it leaves the limits of the mountain and passes to the smooth prairies, only nine or ten miles from its source, and the rocky wall-like divide which abruptly terminates its valley. This divide, when crossed at its highest point by the trail, is 7,600 feet above the sea; and its height, where seemed to be the most favorable opportunity of tunnelling, is apparently 500 to 1,000 feet higher. A tunnel of two and a half miles (an uncertain estimate from the manner in which the divide was crossed) would probably reduce the elevation so far as it is practicable to do so by tunnelling, the mountain being pierced at an elevation of 5,450 feet; but the rapid descent of the tributary of Flathead river, to which we pass on the west for the first seventeen miles, in which distance it falls 2,170 feet below the level assigned to the tunnel, is so objectionable that this route is not likely to come into competition with the passes farther south. On the other side, the tributary of Marias river descends near 1,200 feet in sixteen miles. There are, probably, passages of the mountains connecting other branches of the Marias river with other tributaries of Flathead river, and giving, perhaps, opportunities for passing the divide with more ease than by the way explored; and should a line in this direction be thought desirable, it should be remembered that the field has been very partially explored. The mountains here have, however, a very different character from what they have farther south, being higher and forbidding, their sharp, gray peaks stripped of all vegetation, in every direction towering above the mass of wooded mountains and valleys below them.

A route through this pass can be preferable only as connecting with a route to the north of Flathead river. To follow down the valley of Flathead river after arriving at Flathead lake, will make it greater in length, in addition to its other disadvantages. The reconnaissance did not show that it was impossible to proceed westwardly in a more direct line, but the only two places in the valley containing Flathead lake and river, which were not bounded by high hills or mountains on the western border, are at the north and south extremities of Flathead lake. These were the only places where there appeared any possibility of breaking through the mountains. At the south extremity of Flathead lake is a small break in the hills, running in a nearly west direction, but this small valley has no stream of any importance in it, and there is nothing to show that it extends farther than can be seen from the lake, a half dozen miles. At the upper end of the lake the hills on the west side of the valley appear to cease for a while. There is a prairie here of considerable extent, the eastern edge of which was followed by Mr. Tinkham, and it may be practicable upon this prairie to proceed westwardly direct, without following Flathead river to Clark's fork. It is a matter for future examination. Of the route actually examined, Flathead river, from Jocko river to Marias Pass, and from Marias Pass to Fort Benton across the prairie, the most difficult portion has already been noticed, the section of thirty-five miles, including the summit. West of this, for about twenty miles the valley continues narrow, closed in by high, precipitous, wooded mountains, and a railway here must be made with very heavy and expensive work, rock cutting, culvert and bridge work, and sustaining masonry, with some short curves, but without high grades. The valley then opens and closes again but once, and then only for a very short distance, and until reaching Flathead lake the route is very promising in its grades, curves, and the small amount of grading required; but little rock excavation will be necessary. The western shore of Flathead lake crooks abruptly and often, following the base of the wooded and rocky hills which border it. The construction of the road here involves short curves, expensive rock cutting and masonry. The eastern shore appears more promising, but has not been examined. From Flathead lake to Jocko river, following the valley of Flathead river, the route is favorable, generally unwooded, without heavy grading or masonry. East of the mountains a nearly straight line can be obtained from the point where the railway line leaves Milk river to the plains near the base of the mountains, sixteen miles from the divide. This is all dry prairie country, without wood, and with but little water on the surface during the dry season.

The six passes next mentioned above debouche into the valley of the Bitter Root. The routes of Lewis and Clark's Pass and Cadotte's Pass meet in the valley of the Big Blackfoot river, thirteen and a half miles west of the dividing ridge, (Cadotte's Divide.) Those by the two branches of the Little Blackfoot meet and continue for some distance in its valley, which finally connects with Hell Gate fork, in the valley of the Hell Gate river, and the five routes, thus becoming two, follow down these two rivers and enter the Bitter Root valley at Hell Gate. They will be called the Big Blackfoot, Little Blackfoot, and Hell Gate trails; each of the two former being easily reached from the east by two passes over the dividing ridge, and the latter having likewise several connexions, through the mountains, with the regions to the east.

These passes are probably all practicable for a railroad; but the pass from Wisdom river is out of direction, and the Hell Gate and southern Little Blackfoot passes are approached with some difficulty, and involve a considerable detour as regards the approach from the north of the Missouri.

The northern Little Blackfoot Pass is the one by which Mr. Tinkham crossed the Rocky mountains the third time, and in November; is at the source of one of the north forks of Hell Gate river, termed by Lieutenant Mullan Little Blackfoot river, and is remarkably easy. The Indian trail passing here is a well-worn road, and is perfectly practicable for wagons. The dividing ridge is an inconsiderable hill, three hundred to five hundred feet high. Between this pass and the prairies of Marias, Teton, and Sun rivers, the country is somewhat irregular and broken. The barometer gave the summit elevation of the pass at 6,250 feet above the sea, which will probably, in a discussion of the observations, be reduced to less than 6,000 feet.

In pursuing this route, Mr. Tinkham kept south of the Missouri until the gate of the mountain was turned; and for information of the approach north of the Missouri, I am indebted to an exploration under Lieutenant Mullan. In a trip to Fort Benton and back to the St. Mary's valley in March, Lieutenant Mullan brought a wagon through this pass, making the journey from Fort Benton to Cantonment Stevens, a distance of two hundred and ninety-six miles, in twelve travelling days; and there seems scarcely a doubt as to there being an excellent railroad approach to it north of the Missouri, on the route pursued by him. He kept on the high table-land between the Missouri and the Teton, crossed the Sun and the Dearborn rivers a little south of the crossing of the main party in September last; then keeping farther to the south, he crossed the small Prickly Pear creek, and crossing a divide, the one taken by Mr. Tinkham in November, he found the inclination so gradual, that he descended from it not only without locking wheels, but on a run. His course then was by the Little Blackfoot and Hell Gate rivers. A little work is required on this route in cutting timber to get an excellent wagon road. The eastern approach is estimated as practicable with a grade of fifty to sixty feet per mile, the passage of the ridge with a two-mile tunnel, and the western descent with a grade of thirty feet. The valleys of the Little Blackfoot and Hell Gate rivers, from the pass to the junction with the Blackfoot river, are more open and regular than the valley of the latter. Its descent is regular, and, by the barometric observations, is, from the foot of the summit divide to Hell Gate, ninety-five miles, twenty-two and a half feet per mile. The route for the greater portion of the way keeps on the bottom-lands, which are generally unobstructed by timber, sufficient wood always lining the streams for use as fuel, whether for camping or settlement. For lumber, the woods of pines and other evergreens are sufficiently near for use; but the thick woods do not crowd the valley as in some places on Blackfoot river. An open growth of yellow pine occupies the bottom-lands for a few miles in the lower part of the valley, and the cotton-wood growth sometimes stretches across the bottom. The construction of a railway down this valley will probably make necessary the bridging or turning of the main stream several times. Curves will be easy, and the grades used not generally exceed the natural descent of the valley.

The route is indicated on the sketch in dotted lines. It will increase the route forty-four miles, but it may give the means, at the eastern extremity of the Little Blackfoot valley, to make a junction with a road from Council Bluffs. This connexion is indicated on the map. The mountains shutting down on the Missouri, on both banks, to the gate of the mountains, may present an earlier junction of the two routes. The thorough examination of this route, and of the Little Blackfoot trails, with which it connects almost immediately west of the divide, and of the Hell Gate Pass, all three of which have been examined by Lieutenant Mullan, and the full description of which will be found in his reports herewith submitted, will become important should a good connexion be found through the Black Hills with the roads moving westward through Iowa and Missouri; or, should it be found practicable, through the same hills to make a straighter route from the Bois des Sioux than that north of the Missouri.

The southern of the Little Blackfoot routes is singularly direct, and, in common with the Hell Gate route and northern Little Blackfoot, requires little or no labor to make it practicable for wagons. A wagon can now, it is reported by Lieut. Mullan, be taken through the Hell Gate and the southern Little Blackfoot passes.

The two passes of the Big Blackfoot trail are both practicable and have good approaches. The divide of this pass is a narrow and sharp ridge, at whose opposite bases, 2¼ miles apart, head small tributaries of Beaver creek in the east, and Blackfoot river in the west.

Lewis and Clark's Pass connects the headwaters of Dearborn and Blackfoot rivers, and but a few miles north of Cadotte's Pass at the sources of other branches of the same two rivers. The summit ridge has here an elevation of 6,323 feet, in a narrow and sharp ridge, at whose opposite bases, 2¼ miles apart, head small tributaries of Beaver creek in the east, and Blackfoot river in the west.

The pass involves a tunnel of two and a half miles, grades of approach of forty feet to the mile, and grades descending into the valley of not exceeding fifty feet. Cadotte's Pass requires a tunnel of four and a quarter miles at an elevation of about 5,000 feet above the sea. The grades approaching it from the east will be sixty feet, and those from the west forty feet.

This pass connects a tributary of Dearborn river in the east, with a tributary of the Blackfoot river in the west. From the foot of the divide in the east a small tributary falls off with a rapid descent of over one hundred feet to the mile. On either side of the brook are high wooded hills making up into the mass of wooded mountains. The approach to the pass is on the side-hills to the north of the brook. Between the pass and the plains are the tributaries of Beaver creek, rapid mountain streams flowing in deep ravines. The summit is a narrow sharp ridge, about one and a half mile between its opposite bases, and is only partially covered with a small-size growth of trees. The western base is some five hundred feet higher than its opposite, and the least descent, like that of the east, is for a short distance very rapid, favoring the use of a tunnel. Both passes will, on the map, be represented as practicable, but that of Lewis and Clark's will be adopted in the railroad estimate. For full details in relation to these entrances I will refer you to the report of Lieut. Donelson and the sub-reports of Messrs. Lander and Tinkham.

It is proper here to observe that the railroad line was not carried down the entire distance from Lewis and Clark's Pass to its connexion with the line from the pass in the Blackfoot trail by Mr. Lander; a link of about four and a half miles is wanting. As regards the former, it is established that it can be approached by a grade of forty feet, that the mountain can be pierced by a tunnel 2.59 miles in length, and that for seven and a half miles the general inclination of the valley is forty to fifty feet per mile. The connexion has not been made, though believed to be practicable at a grade not exceeding fifty feet per mile. Should this be established by subsequent examinations, it will prove the preferable route. I have shown on the sketch a comparison of the two routes, in which I indicate the portion not examined on the route pursued by Mr. Lander.

In the Blackfoot trail the grades will vary from thirty-five to forty-five feet per mile. There is a somewhat narrow gorge, ending in Hell Gate, extending some twenty miles, of which the work will be expensive, but the grades will be light, and no sharp curvature.

From Hell Gate the road can run in the valley of the Bitter Root river to Clark's fork, or, by crossing a divide, Clark's fork can be reached by the valley of the Jocko river. The valley of the Bitter Root will involve several heavy bridge crossings, some sharp curvatures, but no grade exceeding fifty feet, and few approaching forty.

Barometrical observations were not made by Mr. Lander in going down the Bitter Root valley, but it is believed no difficulty will exist as to grades. The fall of the river from Lieut. Donelson's camp, on the Bitter Root, of October 5th and 6th, to Horse Plain, is eight hundred feet, and the distance seventy-two miles, and gives, on the supposition of a uniform grade, $11\frac{1}{9}$ feet to the mile. By reference to Dr. Suckley's report it will be seen that he made the whole distance with boats, meeting no rapids that interfered with the navigation of the river, and his observations in reference to its practicability for a railroad confirm the opinion of Mr. Lander, in whose judgment and experience I place great confidence. The route will be long, in consequence of the curves of the river, and will involve curves of the minimum radius, numerous bridge crossings, considerable side-cutting, and high embankments on the prairie portions in consequence of the spring freshets. The rock in side-cuttings can be easily quarried. The greater portion of this route has been personally examined by me, and I am satisfied of its practicability, though at great expense.

The divide of the Jocko, though five hundred and sixty feet above Hell Gate, is entirely practicable. To overcome the summit the approach may require a grade of fifty feet, and the descent a grade of sixty feet; both, however, for short distances, with heavy embankments and probably a lofty bridge. Farther down the valley is open and easy, and the grades do not exceed twenty feet. There are no short curvatures. Lieut. Donelson is of opinion that these grades may be reduced to forty-five and forty feet.

The distance to Horse Plain from Hell Gate by the two routes is 136 miles by the Jocko, and 143 miles by the Bitter Root, giving seven miles in favor of the former route. It is probable that the greater amount of curvature on the Bitter Root would be at least as serious a difficulty as the greater grades of the Jocko. The cost of the Jocko will probably be some half a million of dollars less than that of the Bitter Root.

It is probable that a better connexion than either of these could be made by leaving the Blackfoot trail some distance before entering the defile, passing over a low divide, and pursuing the valley of one or two streams which flow into Clark's fork. One of these streams is probably a tributary of the Jocko river. Enough is known of the country through an exploration made by Mr. Tinkham, under the direction of Lieutenant Donelson, to make it probable that the grades will not exceed forty feet, and that the curves and expensive embankments, and sustaining walls of the defile ending in Hell Gate, and of the Bitter Root valley, and the high grades of the Jocko route, will thus be avoided. The route is indicated by dotted lines on the sketch, and should be carefully examined in subsequent surveys. By referring to Mr. Tinkham's route, as shown on the map and explained in his report, it will be seen that he observed all but a few miles of both routes, and that the connexion is almost certain.

I will observe, however, that the examinations of this mountain range, whilst they have been exceedingly satisfactory, and have established the practicability of a railroad route through them, are by no means complete.

It is not doubted there are other passes in this portion of the Rocky mountain range even better than those explored; they are indicated by the general depression of the mountain range, with the greater frequency of the streams stretching out to meet each other from the opposite slopes of the mountains; and I consider it important that, in future operations, a whole season should be directed to their thorough examination, and that instrumental surveys should be made of the pass found to be the most practicable.

In the construction of the road through the Rocky mountains, there will be a scarcity of wood and water in the approach from Milk river, which can be remedied by bringing water in aqueducts from Grizzly Bear lake, and wood from the Rocky mountains, which furnish an inexhaustible supply.

CHAPTER VII.

General Geographical Description of the Rocky Mountains Region.

Entering the mountains on the eastern side are the tributaries of Marias, Teton, Sun, Dearborn, and Jefferson rivers; the latter, one of the principal forks of the Missouri river. On the west the rivers Clark's Fork of the Columbia, Blackfoot and Hell Gate forks, together with that branch of Bitter Root river retaining its name, and the tributaries of the Snake river, are the principal streams, whose valleys cut the mountains in transverse ranges, and whose sources are separated from the headwaters of the Missouri tributaries by ridges one to three miles in width, and rising from five hundred to two thousand feet above the running water on the opposite sides of the summit.

Excepting the rocky and rugged peaks and ridges of unusual elevation, the mountain slopes are covered with wood, consisting of the different varieties of pine, (generally a species of yellow pine,) firs and spruces, a small proportion of white cedars, and occasionally an intermingling of the white birch. In the bottoms of the streams is found the bitter cotton-wood. The pines, and especially the pines of the valleys, will afford much superior lumber, and, as found in the bottom-lands of streams, and in the lower and easier mountain slopes, are tall and straight, and have a diameter of about three feet, and a height of from one hundred to one hundred and forty feet.

The streams intruding into these wooded regions have in them a considerable amount of open and grassed lands. The valleys of the smaller tributaries of Clark's fork are generally wooded until within a short distance of Flathead lake; both the Big and Little Blackfoot Fork valleys are wooded, but their bottoms contain many extensive and handsome prairies. Hell Gate fork has a growth of heavy pine and fir on the bordering hills, and an extensive prairie valley of eight hundred to one thousand square miles. St. Mary's river has a handsome, open valley, six or eight miles wide, of even greater extent, and, in connexion with all the streams, is sufficiently supplied with pine and cotton-wood for the purpose of settlement. That portion of the Snake River valley explored was found to be destitute of timber, excepting in some places where the supply was good. The valley is generally very scanty in vegetation, almost the only growth being the wild sage. The valley for hundreds of miles is covered with beds of volcanic rock. Clark's fork has an open, wide valley, extending to the Flathead lake, and in the vicinity of the temporary British trading post, about twenty miles south of the lake, is connected with several other smooth and fertile valleys, extending southeasterly into the mountains. All of these bottom-lands have a fertile, although sometimes a gravelly or stony soil, and touch upon forests abundantly supplied with valuable pine lumber. At the head and foot of the Flathead lake are open prairies, with good soil, and possessing the resources for a delightful farming location. The east and west sides of this beautiful lake are hilly and wooded; the eastern side thinly timbered.

All these open lands are covered with an abundance of grass, and afford excellent pasturage for horses and cattle throughout the year.

Between the headwaters of the Bitter Root and the Snake river the mountains are formed into low ridges, between which intervene valleys rich in grass and watered by mountain streams, and affording fairest grazing lands for the Indians with their large bands of horses.

The country is abundantly watered with clear mountain streams, with pebbly beds; and lake and stream abound with fish.

Trap rock, in its different forms, is the principal geological formation from the divide separating the waters of Snake river from those of the three forks of the Missouri to Fort Hall, and limestone, occasionally intermingled with trap, thence northward to the limits of the survey. Granite discovers itself in the southern portion of the survey, and elsewhere. A very superior limestone, suitable as a building-stone and for the manufacture of lime, exists in the mountain range east and north from the British trading post already referred to, and undoubtedly exists elsewhere in large quantities.

A belt on the eastern slope of the mountains, including the valleys of the streams, possesses much the same characteristics of soil as already noticed on the western slopes, but has less advantages for lumbering, and has a colder climate. This fertile strip gradually passes into the Grand Prairie country, and, on leaving the vicinity of the mountains, the soil gradually becomes more thin, except in the numerous broad river valleys, as those of the High Wood, the Judith, the Muscle Shell, &c., &c. The pines end with the mountains, and the only trees are found in the growth of cotton-wood lining the streams. Immediately under the mountains is a region capable of profitable tillage, and with unlimited pasturage, delightful in summer, and though colder than the western valleys, is still milder than the climate of the plains still farther to the east.

I estimate that in the valleys on the western slopes of the Rocky mountains, and extending no farther west than the Bitter Root range of mountains, there may be some 6,000 square miles of arable land, open grassed lands with good soils, and already prepared for occupation and settlement; and that, in addition to this amount, there are valleys having good soils, and favorable for settlement, which will be cleared in the removal of lumber from them. The faint attempts made by the Indians at cultivating the soil have been attended with good success, and fair returns might be expected of all such crops as are adapted to the northern States of our country. The pasturage grounds are unsurpassed. The extensive bands of horses owned by the Flathead Indians occupying St. Mary's village, on Bitter Root river, thrive well winter and summer. One hundred horses belonging to the exploration are wintered in this valley, and up to the 9th of March the grass was fine, but little snow had fallen, and the weather was mild. The oxen and cows owned here by the half-breeds and Indians obtain good feed and are in good condition.

Probably 4,000 square miles of tillable land is to be found immediately on the eastern slopes, and the bottoms of the different streams, retaining their fertility for some distance after leaving the mountains, will considerably increase this amount. There is a marked difference of climate between the two sides, and the comparison of the meteorological results of the winter posts established—one at Fort Benton, on the Missouri, and the other near St. Mary's village, on opposite sides of the mountains—will be of great interest as determining with some definiteness the extent of this difference. The question of climate will be considered more fully hereafter.

To bring out more clearly the character of the mountain region, I will, at the risk of some repetition, quote from Lieutenant Mullan's report of his exploration to Fort Hall:

"Thus we found ourselves at the main camp after an absence of forty-five days, during which time we had crossed the mountains four times, completely turning the eastern portion of the Bitter Root range, by a line of seven hundred miles, experiencing a complete change of climate, and crossing two sections of country, different in soil, formation, natural features, capability, and general character; crossing, therefore, in all their ramifications, the headwaters of the two great rivers, Missouri and Columbia. We had now a fine opportunity to compare the climate and character of the Bitter Root valley with that of the Hell Gate and others in its vicinity. In the latter, snow from four to six inches deep was to be found, while in the former the ground was perfectly free from snow. It seemed as if we had entered an entirely different region and different climate; the Bitter Root valley thus proving that it well merits the name of the valley of perennial spring. The fact of the exceedingly mild winters in this valley has been noticed and remarked by every one who has ever been in it during the winter season; thus affording an excellent rendezvous and recruiting station for the Indians in its vicinity, and of those sojourning in it, as well as all others that might be overtaken by the cold or snow of the mountains. It is the home of the Flathead Indians, where, through the instrumentality and exertions of the Jesuit priests, they have built up a village—not of lodges, but of houses—where they repair every winter; and with this valley, covered with an abundance of rich and nutritious grass, affording to their large bands of horses grazing and to spare, they live as contentedly and as happily as probably any tribe of Indians either east or west of the Rocky mountains. Its capabilities in other respects, aside from grazing, have already been referred to in the former part of this report, and are of sufficient interest and importance to attract the attention of, and hold out inducements to settlers and others. All that it at present needs is, to have some direct connexion with the East or the West, and the advantages that it and the sections in its vicinity possess, will be of sufficient importance to necessarily command attention. The numerous mountain rivulets, tributaries to the Bitter Root river, that run through the valley, afford excellent and abundant mill-sites; and the land bordering these streams is fertile and productive, and has been proved, beyond a cavil or doubt, to be well suited to every branch of agriculture. I have seen oats grown in this valley by Mr. John Owen, that are as heavy and as excellent as any that I have ever seen in the States; and the same gentleman has informed me that he has grown most excellent wheat, and that, from his experience while in the mountains, he hesitates not in saying, that here might agriculture be carried on in its numerous branches, and to the exceeding great interest and gain of those engaged in it. The valley and mountain-slopes are well timbered with an excellent growth of pine, which is equal in every respect to the well known and noted pine of Oregon. The advantages, therefore, possessed by this section, are of great importance, and offer peculiar inducements to the settler. Its valley is not only capable of grazing immense bands of stock of every kind, but is also capable of supporting a dense population. The mountain slopes on either side of the valley, and the land along the base of the mountains, afford at all seasons, even during the most severe winters, grazing ground in abundance, while the mountains are covered with a beautiful growth of pine. The provisions of nature here, are, therefore, on no small scale, and of no small importance; and let those who have imagined—and some have been so bold as to say it—that there exists only one immense bed of mountains from the headwaters of the Missouri to the Cascade range, turn their attention to this section, and let them contemplate its advantages and resources, and ask themselves, since these things exist, can it be long before public attention shall be attracted and fastened upon this hitherto unknown and neglected region? Can it be that we should have so near our Pacific coast a section of country of hundreds of thousands of acres that will remain forever untilled, uncultivated, totally neglected? It cannot be. But let a connexion, and that the most direct, be made between the main chain of the Rocky mountains and the Pacific—and it can be done—and soon will these advantages necessarily thrust themselves upon public attention, and open to the industrious and persevering, avenues to wealth and power. Again, this section connects with another of equal if not superior importance, that of the Cœur d'Alene country, which again connects, directly, by a beautiful section, with the country at and near Wallah-Wallah; thus showing that from the main chain of the Rocky mountains to the mouth of the Columbia, we possess a rich, fertile, and productive area, that needs but the proper means and measures to be put forth, and manfully employed, to be turned to private and public benefit." * * * "Looking back upon our route, we saw we had followed Bitter Root river to its head, which we found from its mouth to be ninety-five miles long, flowing through a wide and beautiful valley, whose soil is fertile and productive, well timbered with the pine and cotton-wood, but whose chief characteristic and capability is that of grazing large herds of cattle, and affording excellent-mill sites along the numerous streams flowing from the mountains. The country thence is watered by tributaries to the Missouri and its forks, to the range of mountains separating these waters from those of the

Snake river, or the south branch of Lewis' fork of the Columbia, and is also fertile, but its characteristic feature is the great scarcity of timber for any purpose, the willow and wild sage being used for fuel along the whole route. The geological formation of this section belongs to the tertiary period. The capability of this broad area, however, for grazing, is excellent. It is a great resort at present for all Indians in the mountains, the mountains and valleys affording a great abundance of game, consisting of elk, bear, deer, and antelope, while the numerous rivers and streams abound in fish and beaver. The latter are still caught in large numbers on the headwaters and tributaries of the Missouri, but are not so anxiously sought after as years back, owing to the great depreciation of value in the market east. The whole country is formed of a series of beds of mountainous ranges or ridges, with their intervening valleys, all of which are well defined and marked, the decomposition and washings of the rocks of the mountains giving character to the soil of the valleys, which may be termed, as a general thing, fertile. The geological formations along the Jefferson fork and its principal tributaries are limestone and conglomerate rock. From the range called the Snake River divide, the whole character of the country is completely changed. Here the geological formation is basaltic and volcanic principally. None of the numerons streams and rivulets flowing from the mountains along the route we travelled emptied into the Snake river, but either sunk into the ground or formed small lakes in the broad valley of Snake river. The ground in most places is formed principally of sand; and where large beds of basalt are not found, the ground is of a dry, absorbing nature, through which the water sinks, at times bursting out again. It was somewhat singular that for sixty miles above Fort Hall, along the main stream of Snake river, we did not cross but one tributary, and that coming in from the south, while none came in from the north; all of the streams, as before mentioned, either forming lakes or sinking into the ground. This section is also noted for the great scarcity of timber, and the immense plains of wild sage; which is so abundant, that it merits the name of the sage desert of the mountains. It extends for many miles in length and breadth, forming an immense ocean of prairie, whose sameness is only broken by the 'Three Buttes' of the valley, which rise like islands in the sea in this broad and barren area. Its whole character might be included in the word sterility. From the mountains bounding the Snake River valley on the north to Fort Hall, a travelled distance of one hundred and twelve miles, there is but one fertile spot of ground that could be converted to any useful purpose, and this is found at Cantonment Loring, five miles above Fort Hall. Here the soil is of a grayish-blue clay and sand, that might be made use of for agricultural purposes. The grazing here is most excellent. To our return route to the Bitter Root valley, which lay to the east of the Bitter Root mountains from the Snake river, to the ridge separating the waters of Wisdom river, or the Big Hole fork of the Jefferson river, from those of the Hell Gate river, the same general remarks will apply as those describing the country from the head of the Bitter Root river to Fort Hall—a series of mountain ranges, giving beautiful prairie valleys, through which wind streams from the mountain slopes that pour their tribute into the Missouri and its forks. Leaving the ridges referred to, you again enter a different and milder region, through which flow tributaries to the Clark's fork of the Columbia. Here the soil is a rich loam, timber is abundant, and climate exceedingly mild even during the severest winter. We entered it on the 1st of January, and snow scarcely covering the ground was to be found in the valley. This section connects with the Bitter Root valley. We thence followed down the Hell Gate river, from its head to where it debouches from the mountains five miles above its mouth; which we found to be one hundred and twenty miles long, flowing through a fertile, well-timbered valley, from two to five miles wide, bounded on each side by high pine-clad mountains. Game is found in great abundance in these mountains, being principally elk and bear.

"A detailed description of each portion of the route having already been given, I only deem it necessary to say that both routes travelled are perfectly practicable for wagons, but the return route is by far the better of the two, though from sixty to eighty miles the longer."

The general character of the Hell Gate river, its valley, and the adjacent mountain slopes, has been stated. Two routes leading from this river to Fort Benton were examined by Lieutenant Mullan in the month of March, 1854: one along the Little Blackfoot and its south fork, across the mountains to the Missouri, and thence along the bluffs or the banks of that river to Fort Benton; and the other leading up the north fork of the Little Blackfoot and to Fort Benton, north of the Missouri, and on the prairies between that stream and the route pursued by the main party of the exploration in September, 1853. At the forks of the Little Blackfoot, Lieutenant Mullan found the snow in March ten inches deep. The bluffs on the banks of the Missouri, alluded to above, may be considered as extending from a point thirty miles above the falls to near the three forks of that river. They may be described as formidable mountain spurs, extending along the Missouri for about one hundred and fifty miles, and being fifteen miles wide, the principal formations consisting of granite, the growth being an abundance of the large species of pine; and these characteristics, together with the fact that it was exceedingly difficult for a pack train to pass through these spurs, indicated that here a route from east to west, either for a rail or wagon road, must be sought at a greater distance from the Missouri. This river flows through these spurs in what is called by Lewis and Clark the "Gate of the Mountains." It has here a rapid current, and is, in places, very deep and narrow. Lieutenant Mullan arrived at Fort Benton on the morning of the 14th, and started on his return to the Bitter Root valley on that of the 17th of March, carrying with him a wagon drawn by four mules. He arrived at the St. Mary's village on the 30th of March. The principal facts of the geography of the country which were developed by Lieutenant Mullan during this tour are as follows: First, as to the climate, he crossed those mountains at a time when it has been hitherto thought impracticable to travel; found, in the beginning of March, ten inches of snow at the forks of the Little Blackfoot; no snow east of the mountains; and on his return, in the latter part of March, found no snow at all on the route; and he had good grass throughout the journey for his animals. Second, as to the facility of communication, he found plenty of wood and water, but an indifferent route even for a pack-train in going to Fort Benton, and in returning he passed over a country which was favorable for a wagon road, and which presented a very fine approach to the mountains for a railroad; and the divide, where he crossed it, being a low ridge, with an almost imperceptible ascent and descent. All these facts will give this one a favorable place, when considered in competition for a railroad route with the others examined.

For detailed information in regard to the general character of the mountain region, I will refer you to the sub-reports of Lieutenant Mullan, G No. 23, G No. 24, G No. 25; of Lieutenant Donelson, F No. 18; of Mr. Tinkham, F No. 19; of Dr. John Evans, F No. 20.

CHAPTER VIII.

General Characteristics of the Great Plain of the Columbia, and Navigability of the Columbia River.

In reference to the Cascade mountains, the geography of this whole range has been represented very inaccurately on all existing maps. The region between the Cœur d'Alene and the Cascade mountains may be described as follows:

It extends with an average of over 200 miles between these two ranges; and from the Blue mountains, at the sources of the John Day river, Umatilla, and the southern tributaries of the Wallah-Wallah river, to the Kootenaies mountains, north of Clark's fork, is marked by the Columbia and its principal tributaries—Clark's fork or Flathead, and Lewis or Snake river. The general course of the Columbia is north and south, with two large bends—one to the westward from Fort Okinakane, and the other to the eastward, approaching Wallah-Wallah. The Spokane river is the principal remaining tributary on the east, and the Yakima the most important one on the west of the river. The Yakima and its tributaries lead to the only two passes of the Cascades that can well be availed of for wagon roads, and one of which—the Snoqualme Pass—having two routes over the divide, will probably furnish a feasible railroad route.

North of the Spokane river, and for a few miles south of it, the country is well timbered and well watered, with many fertile prairies and valleys. The valleys of the Cœur d'Alene and Spokane rivers, the valley extending from the Spokane to Colville, the Cœur d'Alene prairie, and the country generally between the Cœur d'Alene and Pend d'Oreille lakes, are well adapted to grazing and agriculture. The Flat Bow river, whose general course is parallel to that of the Flathead river, or Clark's fork, makes a re-entering into our territory nearly to 48° 30′, has much good land on its banks, and the country between it and the Flathead lake is generally prairie, the divide being low. One of the routes from the Flathead lake to the Pend d'Oreille lake is by the southern bend of the Flat Bow river.

I have denominated the prairie region, between the Cœur d'Alene mountains and the Cascades, the Great Plain of the Columbia. The formation of the central and western portions is trap, and it presents great variety of surface and character, from fertile and well-watered valleys to desert sage plains, and from gently undulating waves of vegetation to basaltic columns, deep cañons, and the various outcroppings observed in such formations. The Cœur d'Alene mountains are a vast mass of limestone, and the valleys on its western slope are rich and inviting. Thus, on the Kooskooskia there is a fine agricultural and grazing region, and in December Mr. Tinkham found the grass perfectly green, peas up, and flowers in blossom. So of the several tributaries flowing into the Cœur d'Alene lake. The St. Joseph's, the most southern tributary, and which probably furnishes a route across the mountains better than the Cœur d'Alene or either of the Nez Perces trails, and which it is said can be made practicable for wagons at very small expense, has many large and extensive prairies, and the whole region westward to the route pursued by the main party is profusely watered, and well adapted to grazing. Indeed, for the entire region east of the Columbia, the country, with a few exceptions, as in the vicinity of the Grand Coulée, along certain portions of the Snake and Peluse rivers, may be called a good grazing country, and on no route pursued by voyageurs, by Indians, or by the parties of my exploration, were there long distances between water. The longest distance made was from the

Tou-chet river to the Snake, twenty-eight miles; yet, by a slight deflection to the east, water can be got at shorter intervals than twenty miles.

Lewis or Snake river, after cutting out a corner of Washington Territory, turns southward into Oregon, leaving, however, a tributary to the eastward—the Little Salmon or Kooskooskia river—which, passing through the Nez Perces country, forks and affords two trails through the Cœur d'Alene mountains, called the northern and southern Nez Perces trails.

In the re-entering formed by the Snake, whilst most of the country between the Snake and the Wallah-Wallah, along the Columbia, and for some twenty miles back, has but little arable land, there is good though somewhat scant bunch-grass over nearly the whole surface, and the Wallah-Wallah itself, with its numerous tributaries, affords excellent arable and grazing land. It has already attracted the attention of emigrants, and if the Indian title were ever extinguished, it would be rapidly filled up.

The Spokane river, and its principal tributary, the Cœur d'Alene river, and Clark's fork, furnish the other two trails through the Cœur d'Alene range.

These four trails have already been described, and the route of Clark's fork indicated as the most practicable one for a railroad route. On this river is the Pend d'Oreille lake, forty-five miles long, and on the Cœur d'Alene tributary of the Spokane river, the Cœur d'Alene lake. Between the Pend d'Oreille lake and the country from the Cœur d'Alene lake to the falls of the Spokane, the country is favorable, the divide low, and feasible routes are afforded for passing from Clark's fork to the Spokane plain, and across the Columbia. This gives a southwestern direction to the railroad route. Westward, however, of this favorable region of country, a high range of mountains extends across Clark's fork, and presents obstacles to the construction of the road either towards the mouth of Clark's fork or Colville, though, as will be seen by reference to the report of Lieutenant Arnold, accompanying that of Lieutenant Donelson, a practicable route probably exists, and could be made use of did the connexion west require it. Westward of the Columbia river, at these points, the country is very rugged, indeed impracticable, and leads to the abandonment of all plans of reaching the passes of the Cascades in this direction.

From the Cœur d'Alene mission, some miles above the Cœur d'Alene lake, there is a good wagon trail to Wallah-Wallah. There is also said to be a good wagon trail from the Pend d'Oreille lake, keeping on its eastern and southern shore, to the Cœur d'Alene mission and to the Cœur d'Alene river, and an excellent railroad route, which is marked on the sketch.

As regards the great features of the country west of the mountains in reference to its practicability for a railroad, viz: the Bitter Root, Clark's Fork, and Columbia rivers, I will state that Dr. Suckley, the surgeon and naturalist of the eastern division of the exploration, left St. Mary's village on the 15th of October, and, proceeding down the Bitter Root and Clark's fork, reached Columbia barracks on the 6th of December, making the whole distance, except about sixty miles from the Pend d'Oreille mission to Colville, by water. The distance was 1,049 miles, (estimated,) the running time 285½ hours, made in fifty-three days, or 3.67 miles per hour. But three portages of magnitude were made—one of thirteen hundred paces on Clark's Fork river, above the Pend d'Oreille lake, one on the Columbia, at the Dalles, of eight hundred paces, and one at the Cascades, one and a half mile in length.

From Horse Plain, at the confluence of Clark's fork and the Bitter Root river, the whole distance to the mouth of the Columbia readily admits the rafting of lumber, and it is probable that logs can be run to Horse Plain from the upper valley of the Bitter Root in the freshets of spring, and from and above the Flathead lake, on Clark's fork.

The forest growth on the banks of the Columbia above the mouth of the Wenatshapam can be transported down to any point of the river where it may be needed for fuel, for buildings, and for constructions. Thus, for all practical purposes of railroad construction, the Columbia throughout its entire length may be considered as bountifully supplied with wood.

With reference to the growth along its banks, I will quote from the report of Dr. Suckley:

"While on the subject of timber, I will briefly allude to its quality and quantity. Along the Bitter Root and Hell Gate rivers, and in the mountains in their vicinity, the red pine and the larch, favorite trees in ship-building, are found in great quantities. Farther down their streams we find, in addition, cypress, cedar, hemlock, spruce, and fir, besides several hard-wood trees. The timber country extends from the main range of the Rocky mountains to a point about 80 miles below Fort Colville. From thence to the Dalles there is no timber. At the Dalles it again appears, and trees of many descriptions, and frequently of enormous size, are found thickly covering the valleys and surrounding hills."

Also, in reference to other subjects, he says: "Good building-stone is found along nearly the whole route. There are a few pieces of excellent land along these rivers; their waters are clear and beautiful, and filled with thousands of fish of the different kinds of the salmon family."

By trifling improvements on Clark's fork and the Columbia several considerable lines of communication by steamers could be opened, which would greatly facilitate the construction of the road. The Hudson's Bay Company's large freight boats ascend from the lower end of Pend d'Oreille lake to Horse Plain, a distance of one hundred and thirty-five miles, making two portages, and descend from above our northern parallel to Vancouver. Steamers drawing from 20 to 24 inches of water can, at low stages, ascend to nine miles above the lake, and still farther at higher stages of water. Between Colville and De Chute's rivers, on the Columbia, there are but three bad obstacles to navigation for steamers drawing 20 to 30 inches of water, viz: Kettle falls, the Priest's and Buckland's rapids. A portage would probably be required at each of these places. None would be required at Ross's rapids, nor at any other points below the mouth of the Spokane than those designated. One or more may be required between Okinakane and the Kettle falls. The Cascades and the Dalles are also bad obstacles. By improvements either in the bed of the river or in the use of locks at these several points on the Columbia and Clark's fork, and by the substitution of the rail where such improvement is impracticable, it is not doubted that a continuous communication can be established from the mouth of the Columbia to the mouth of the Spokane, and probably to Colville, and from the Pend d'Oreille lake to Horse Plain. Rails will undoubtedly be required at several of the places, and transfers be made from steamer to steamer.

The steamers should be of light draught, great power, and will be used chiefly as tow-boats. By a thorough organization, transportation could be effected at a moderate expense, when the amount is sufficient, as in the case of a railroad, to authorize the requisite preliminary outlay. The present high rates of transportation by the Columbia river arise from the monopoly that is exercised and the scarcity of labor. In the construction of the road the river must be availed of to the mouth of the Yakima, and for 135 miles on Clark's fork, from the Pend d'Oreille lake to Horse Plain.

For many interesting details in reference to this river, the country, and forest growth of its banks, the advantages which it affords for manufacturing, and for suggestions in reference to introducing the salmon into the upper country, and thus affording food to the almost starved Indians, by blasting a race-way in the Great Falls twenty-five miles above the mouth of Clark's fork, I will refer you to Dr. Suckley's report, a copy of which is given in the appendix.

I will also refer you to the reports of Captain McClellan, Lieutenant Donelson, Lieutenant Saxton, and Lieutenant Arnold. The latter officer, after having ascertained the latitude of the mouth of Clark's fork, which was about 49°, ran a line from Fort Colville, by the Grand Coulée, the mouth of the Spokane, and the mouth of Snake river, to Wallah-Wallah.

Lieutenant Arnold says as follows in relation to the Grand Coulée and the vicinity between it and the Columbia:

"I again descended to the river by a steep and rocky trail, and marched three miles, encamping near the mouth of the coulée.

"The trail leaves the river to the north, and passes nearly south. After an ascent of 243 feet we arrived upon a level which commands a fine view of the coulée; it was about ten miles wide at the north entrance, and gradually widened until it passed out of sight; its walls were about 800 feet high, and one solid mass of rock basalt, cemented together by lava or some more fusible rock. The trail had a gradual fall for about six miles, which gives a fair index of the ground included between the walls.

"This coulée was twenty miles in length; its walls then passed out of sight, to the west.

"The soil was generally sand, except near the walls, where it was made up of disintegrated rock.

"The line of march the succeeding day was very rocky for six miles, when we entered the second coulée in size. This coulée has the general appearance of the former. Travelling through this, we again entered the Hudson's Bay trail, near a high, rocky mound. To remove any doubt that may remain on the minds of others in regard to the Grand Coulée, which is laid down on the maps about ninety miles in length, I will state I obtained the best guide in the country. He was born in this country, and has travelled the route for the last fifteen years. I questioned him very closely in regard to the route travelled by Lieutenant Johnson in 1841. The coulée through which he travelled is not known as the *Grande Coulée* among the old residents.

"After travelling a few miles, I crossed this stream and passed a fine lake about six miles in length and one in width; it was fringed with alder bushes, and filled with wild fowl, duck, geese, and white swan. Along the eastern bank of this lake I again commanded a view of the range along the western bank of the Columbia, as far north as Pisquouse river. This view, taken in connexion with the information I have received from my guide, leads me to believe that the country bounded on the east by my line of march, north and west by the Columbia, on the south by a line passing through the mouth of the Pisquouse river, and the southern extremity of the second coulée previously spoken of, is filled with coulées running in every direction, and ranging from one to fifteen miles in length."

CHAPTER IX.

Description of the Cascade Mountains and the Pass of the Columbia River.

In reference to the Cascade mountains, the entire geography of the eastern slope, which has been represented very inaccurately on all existing maps, has been developed from the Columbia river to above the forty-ninth parallel, and a good portion of the western slope to Puget sound. The highest mountains of the Cascade range on the Columbia river are at the Cascades, and at the mouth of the White Salmon and Telickitch rivers, from which points spring the main Cascade ranges, running to the north up to Mount St. Helens and Mount Adams, and centering still farther north in Mount Rainier. Thence one main chain runs off to Mount Baker, having, however, a deep re-entering to the east, through which issues a stream, which, winding round Mount Baker, flows into Bellingham bay, giving the appearance of a pass from the waters of the sound, and another runs off to the northeast.

Eastward, and from a range coursing along, and some six or eight miles south of, the Yakima, to above our northern parallel, the Cascades, with their innumerable spurs, extend nearly to the Columbia river, causing nearly the whole country to be mountainous, or high, broken table-land. The streams are rapid, have their sources in lakes, frequently of large size, and are not even adapted to the rafting of lumber. North of the Columbia river a range of hills extends nearly parallel to it, at some eight miles distance, and heavily wooded. From these hills flow many small streams to the Columbia, and the grazing is excellent over this intermediate space from Wallah-Wallah to the Dalles. Much of this is good farming land.

The streams on the western slope flow in nearly a northern direction, and the mountain spurs between them, in many cases, extend to near the shores of the sound. Reserving to a subsequent occasion some account of the sound, and the country tributary to it, I will now consider the passes of the Cascades practicable for a railroad.

There are two practicable passes, both having good connexions with the line of Clark's fork: that by the Columbia itself to the Cowlitz river, a stream which rises in Mount St. Helens, flows in nearly a southerly direction, and empties into the Columbia river about forty-five miles below Vancouver, and by the Cowlitz river to the sound, and that by the main Yakima and Snoqualme rivers.

The pass of the Columbia river, examined personally by myself, as well as by Captain McClellan and Mr. Lander, is remarkably favorable in its grades, which rarely exceed ten feet; in the ease with which debris from the ledges can be worked, to form the embankments required to guard against freshets; and the great facility with which wood and stone, both of good quality, can be transported down the Columbia for purposes of construction. The only serious obstacle is Cape Horn mountain, which, to avoid sharp curvature, may require a tunnel seven hundred feet in length, though it is hardly probable that the road may be run over a gap in rear of it without tunnelling, heavy work, or steep grades. The lateness of the season prevented the examination. Vancouver would furnish an admirable depot, and also afford a crossing in its vicinity to the valley of the Willamette. The grades down the Columbia to near the mouth of the Cowlitz, and thence to Olympia, Steilacoom, or Seattle, on the sound, will be small; the work throughout light; and abundant materials of all kinds will be found for road-beds and superstructure.

The crossing of the Columbia at the Snake river presents no special difficulties. From the Dalles to Vancouver, there will be expensive rock-cutting. All the streams can be easily bridged.

This is not the place to discuss whether the road should keep north or south of the Columbia river the whole distance. The crossing at Vancouver is undoubtedly objectionable, as interfering with navigation. There is an excellent crossing at the Cascades, at the Dalles, and at several points thence to Wallah-Wallah. The final location cannot be properly made till the practicable connexions are made with the Salt lake, the Willamette valley, and California, to all which routes the line down the Columbia, either in whole or in part, will be the main trunk. It is possible a better deflection to the valley of the Columbia may be found a little more eastward of the present route, close under the base of the Cœur d'Alene mountains, to a crossing of the Snake between the Peluse and the Kooskooskia, and thence to the valley of the Wallah-Wallah river, and thus the route made to lend itself to either bank of the river and its several connexions. In the vicinity of Vancouver, the crossing, instead of being by a bridge, might be effected by suitable ferry-boats. It is sufficient for my present purpose that there is a favorable route down the Columbia, and that a connexion can be made with the valley of the Willamette.

In view of the agricultural, manufacturing, and commercial advantages of Oregon, the navigability of the Columbia to Vancouver and Portland for sea-going vessels and steamers, and the rich character of much of the adjoining country in the Territory of Washington, and looking also to a connexion with California, I am of opinion that a line down the Columbia, thus found eminently practicable by the exploration, must enter into every plan of railroad connexion from the St. Lawrence basin, by the northern route, to the Pacific.

The question simply is, whether the unrivalled commercial advantages of that sound, its being six hundred miles nearer to Asia, making it the natural port of freights and passengers to our entire North and to Europe, are such as will authorize the construction of a road through the Snoqualme Pass, even at the expense of much difficult work and tunnelling, in order to save the increased distance of one hundred and fifty to one hundred and sixty miles of the line of the Cowlitz.

For detailed information in reference to the geographical description of the Cascades, I will respectfully refer you to the reports of Captain George B. McClellan and Lieutenant J. K. Duncan, C No. 7 and C No. 8; and of the line of the Lower Columbia, to the same reports and that of Mr. F. W. Lander, B No. 6. The report of Dr. Cooper, C No. 9, will give some interesting facts in relation to the natural history.

CHAPTER X.

Resources and Geographical Importance of Puget Sound, and its Relations to the Trade of Asia.

Puget sound needs no special description in this report. It has 1,500 miles of shore-line, and many capacious harbors and roadsteads, accessible, commodious, and entirely land-locked. It is particularly adapted to steam navigation.

Steilacoom, Seattle, and Bellingham bay, would be good termini for the railroad; and in relation simply to the route of the Columbia and the Cowlitz, Port Discovery, on the Straits de Fuca; but Seattle combines the greatest number of advantages. As rapidly as the tonnage and draught of vessels have increased in a few years, rising from ten or fifteen hundred to five or six thousand tons, it is hardly probable they will ever exceed the capacity of this harbor, which at low water would admit vessels of fifty feet draught.

The principal resources of the sound are its lumber, its coal, its salmon, and the cod on the banks of the coast, far to the north and south of the entrances to the straits. The coal-beds extend from Bellingham bay to the Cowlitz river, and when subjected to analysis have been pronounced of excellent quality. Such was the opinion of the late Prof. Walter Johnson; and Lieut. Trowbridge, corps of engineers, has, after examination, expressed a favorable opinion of its quality. I regret that I cannot give in the appendix a copy of his letter to the Bellingham Bay Coal Company, which I left at Olympia. I learn, in a recent letter from Olympia, that in June very excellent coal was obtained from the mines in Bellingham bay.

There is also much good land between the Cascades and the ocean. Although, at some points, spurs from the mountains extend nearly to the sound, yet generally there is an interval of prairie or rolling land some thirty or forty miles broad; the river-bottoms generally rich, with an undergrowth of vine, maple and alder. In the vicinity of, and north of Bellingham bay, there are extensive prairies, and the river Nook-sahk, navigable for steamers at least sixty miles, and which, having its source back of Mount Baker, passes under its southern and western base, and finally enters the sound in the northern part of the bay, is represented to have much excellent land on its banks. At the delta of the Sam-ish and Sin-a-ah-mish, and on the D'Wamish and its several tributaries on the Puy-gal-lut, there is much excellent land. The prairies on the southern shore of the Sami are some of them gravelly, particularly those in the vicinity of Nisqually; but, as a general rule, the land is good and yields fair returns to labor. The quality of the land improves on approaching the mountain slopes, and an extensive prairie near the head of the Cowlitz, and at the base of Mount St. Helens, is one of the best tracts of land in the Territory.

The region generally between the Columbia river and the sound, and the Cascades and the Pacific ocean, is well watered. The river bottoms having a growth of pine, maple, alder, and curl-maple, are generally rich, and there is much productive prairie, interspersed with groves of timber, and little or none of the country can be called mountainous. There is a good country along the Willopah and the Chihalis rivers, and from the Chihalis to the head of Hood's canal.

The islands of the sound, moreover, are quite extensive, and Whitby's island, the largest of them all, and in the very centre of the sound, is the garden of the Territory. West of the sound the country is comparatively unknown. It is reported to have great mineral wealth and much excellent land. There will be a great thoroughfare of business and travel from the sound to the Columbia river, and the interests of the two Territories of Oregon and Washington will soon require a railroad.

A question of the highest importance in connexion with the proposed railroad, is the effect which it will have in securing for this country the control of the Asiatic trade. The magnitude of the subject, the want of reliable statistics, and the difficulty in reasoning from the past when political revolutions, mechanical inventions, and new routes of travel are producing such great changes in the relations of commerce, will preclude me from considering the subject in detail. A few general considerations will be sufficient to show the importance of the proposed road as an avenue for the trade of Asia.

The position of this country, standing midway between the great centres of Asiatic and European population, indicates its future commercial greatness. Facing our Pacific possessions, and separated from them by the smooth Pacific, is a vast region covering an area of over twelve millions of square miles, and having a population of over six hundred millions, the outlets of whose commerce and productions are nearer not only to our Pacific, but our Atlantic cities, than to the ports of any European nation; Calcutta, Singapore, Manilla, Canton, and Shanghai being nearer to New York, New Orleans and Charleston, by lines of communication entirely feasible, than to England.

The trade of this vast region, including China, Japan, and the Asiatic Archipelago, has been the great commercial prize in ancient and modern times. Persia, Assyria, Carthage, and Rome, each swayed the world, as it controlled the commerce of the East. Venice, Genoa, Lisbon, Amsterdam, and London, each in its turn attained commercial supremacy, as it became the dispenser of Eastern luxuries to the Western world. The value of the import and export trade of the Asiatic region, which can be made tributary to our commerce, cannot be readily determined; but that of China has been estimated at one hundred and twenty-five millions of dollars per annum, the greater part of which has been carried on by Great Britain; and the annual value of the export and import trade of Great Britain with the Asiatic Archipelago and Pacific islands is estimated at seventy-five millions of dollars.

An important fact bearing upon the feasibility of diverting the trade of Asia from the old channels, is the comparative nearness of our Pacific possessions to the city of Shanghai, which is most favorably situated to become the future emporium of China, and the outlet of trade of over three hundred millions of people, who are just beginning to break away from that exclusive policy which has, for so many centuries, shut them out from the rest of the world. The concentration of British capital at Canton, and its greater nearness to England, has made the latter city the centre of the foreign trade with China. But the silk and tea producing districts lie much nearer to Shanghai, while this city, situated upon a river which is connected with the Yangtze Kiang, the great artery of China, has water communication with one third of the empire. Shanghai, which may be called the New Orleans of China, is distant only 5,000 miles from Puget sound, and the route passes by Japan, with its fifty millions of inhabitants—Jeddo being only 3,660 miles distant from Puget sound.

Nature has clearly indicated the northern pathway for the commerce from the future mart of Asiatic trade to this country and Europe. The great lakes carry us water-borne half-way across the continent. The proposed road communicates on a direct line with the northern lake trade—the most wonderful internal commerce the world has ever known—a traffic which is stated to have amounted in 1851 to $326,000,000, employing 74,000 tons of steam and 138,000 tons of sail-vessels. It intersects the Mississippi river, and thus communicates with the southern States. It is on the line of the great wheat-producing region of America; and, above all, it is on the direct line of the shortest distance between the centres of European and Asiatic population.

The opening of this avenue is already eagerly sought by our own people to facilitate the exchange of their products with those of Asia. From New York to Shanghai, by way of Cape Horn and Lima, the sailing distance is 21,000 miles. By way of the Cape of Good Hope, the distance is ——. From New York to Shanghai, by way of the proposed railroad and Puget sound, the distance will be 7,800 to 8,000 miles—a saving over the sailing routes either of Cape Horn or the Cape of Good Hope, which must carry a great part of the Asiatic trade with our Atlantic cities across the continent. But the Atlantic cities cannot be considered the true points of departure for the Asiatic trade. There must be points in the great interior between the Rocky mountains and the Alleghanies. From St. Paul, on the Mississippi river, to Shanghai, the distance will be less than 7,000 miles; and the inhabitants of the great interior, where the mass of our population will hereafter be situated in their consumption of Asiatic teas, silks and spices, will save the transportation from the seaboard.

In predicting the future course of Asiatic trade, it is presumed that lines of steamships will be established between Shanghai and our Pacific possessions. The coal at Puget sound, lying on the route from San Francisco to Shanghai, will furnish the necessary combustible. It is also presumed that the difficulty of carrying freight, together with the quantity of coal requisite for so long a voyage, will be greatly overcome by the increased size of vessels—steamships of even 10,000 tons burden being now in the course of construction—and also by mechanical inventions and improvements in motive power, which will diminish the quantity of fuel required. It may be safely assumed that, by the time the proposed road is completed, the average time on the Pacific, so much more favorable for steam voyages than the Atlantic, will exceed fifteen miles per hour.

When an uninterrupted line of steam communication is established, a portion of the European trade, and nearly all the travel to Asia, must take its course across our continent, and on the northern road, as the shortest route. The present sailing distance from Liverpool to Shanghai is 14,400 miles. By way of Puget sound the distance will be 10,800 miles; a difference equal to a voyage across the Atlantic. From England to Jeddo, in Japan, the sailing distance is 15,660 miles. By way of Puget sound the distance will be 9,500 miles.

The course of travel is determined by the shortest time. The saving of time will carry European travel and mails even as far as Calcutta, and much more to places farther east and nearer our Pacific possessions, by the proposed route. The average time required to carry the mails from Calcutta to England, on the overland route, is forty-eight days; from Shanghai to England, sixty days. The distance from Calcutta to Puget sound is 8,450 miles, which distance would be performed by steam-vessels, at fifteen miles an hour, in twenty-three days; the 2,800 miles from Puget sound to New York will be run over by passenger trains, moving at thirty miles an hour, in four days; from New York to England, the average time is twelve days; making, in all, thirty-nine days, and a saving in time of nine days from England to Calcutta, and of thirty-three days in the time from New York to Calcutta by way of England. The travel from Shanghai to New York would be performed in eighteen days; from Shanghai to England in thirty days; being a saving of fifty-four days from New York, and thirty days from England.

It may be more doubtful if merchandise will bear the heavy expense of transportation by rail and steam-vessels. It would be hardly safe at present to fix the limits of economical transportation of merchandise, as other elements than mere cost are to be considered. The saving of time is an important element, as is evinced by the high freights paid to clipper-ships, and the higher rates paid for transportation by rail on lines parallel to canals and rivers.

Notwithstanding an increased cost of transportation, all merchandise which is deteriorated by exposure to a tropical climate will take the northern route across the continent. The British sailing route, and our own, cross the equator twice. Teas, as well as other animal and vegetable substances designed for human sustenance, are heated and greatly injured by exposure to a continued high temperature. It is believed that the delicate flavor of tea transported overland from China to St. Petersburg will be preserved in that article transported by sea, when the present tropical exposure is avoided.

A short route to China is of the utmost importance to this country to facilitate the exportation of goods manufactured from the great American staple. Great Britain has penetrated Asia, and commanded its valuable trade almost wholly by her exports of cotton goods. Hitherto we have had no advantage of distance in our competition for this trade. Her advantages for manufacturing are fast diminishing. The prices of labor in that country are increasing. Our own manufacturers of coarse cottons have attained such skill and economy that they command our own markets, and are only restrained in the productions of their enterprise by a want of outlets for their fabrics. Hundreds of millions of people in China and the Asiatic Archipelago are to be supplied with cotton clothing; and the great superiority of the American staple over the India cotton will always create a demand for our fabrics. The English and American manufacturers take their raw material from the same starting point—New Orleans. The former has to transport this material 4,500 miles, to Liverpool, to be manufactured, and the products of the manufacture 14,400 miles, to Shanghai; making, in all, a distance of 18,900 miles. The American manufacturer transports the raw material to Boston, a distance of 1,800 miles. When the proposed railroad is completed, he will have to transport his cotton, from the common starting point, only 9,800 miles to the common market, Shanghai. The American will have in his favor 8,600 miles, and a still greater advantage when manufactures are established at the South. There can be no reasonable doubt that, with the advantages of rapidity of transit, and shortness of distance, all our cotton fabrics of a value exceeding ——— ——— dollars per ton will be transported by rail to Puget sound. It has been estimated that the supply necessary for these new markets will require an amount of cotton equal to the present "entire" crop of upland cotton of the United States. When it is remembered that the United States manufactures only one-third of the entire crop, the rest being exported, and that the capital invested in our own cotton manufactures is $80,000,000, and the annual value of the products of these manufactories is $70,000,000, some conception may be formed of the value of an avenue to Asiatic trade which opens a new outlet for these products.

The manufacturing skill and enterprise of the North, and the resources of the South, are adequate to meet the future demands of an unparalleled trade. It has been said by one of the most intelligent statistical writers of the South, that in process of time the annual product of cotton in the United States can be augmented to six times its present yield, and it will not be more astonishing than its augmentation since 1790; and he continues: "When the cultivation becomes more extended, and to all sections of the 'cotton zone,' covering more than eight degrees of latitude, and more than eighteen degrees of longitude, the probability is lessened of any untoward season or other casualty affecting the aggregate crop injuriously, and consequently the average supply and the prices will be more regular and uniform."

CHAPTER XI.

Railroad Practicability of the Snoqualme Pass.

By referring to the lucid and able reports of Captain McClellan, in charge of the western division, and of Mr. Tinkham, one of the civil engineers of the exploration, the following facts will be found established.

The pass is about 3,500 feet above the sea. The Yakima valley, leading to it, is broad and open, affording an excellent railroad approach. The pass must be overcome by tunnels or inclined planes, or a continuation of both. There are two places for a tunnel: First, one from the level of Lake Willailootzas, about 3,000 feet above the sound, of 4,000 yards (2.27 miles) in length. Second, by a tunnel from the level of Lake Kitchelus, 2,388 feet above Vancouver, 11,840 yards (5.73 miles) in length. The first tunnel has an eastern approach of 18½ miles, with a grade of 48.4 feet per mile. The second tunnel has an eastern approach of 18½ miles, with a grade of 15.2 feet per mile; both on the supposition of uniform grades.

Captain McClellan's survey and barometric profile only extended some three miles beyond the divide; and for the remainder of the route, of which the report of Captain McClellan gives the general features, I am particularly indebted to the winter trip of Mr. Tinkham for the information we possess as to grades and practical difficulties. From the pass to the Snoqualme falls the distance is forty-five miles. On the supposition of uniform grades, the descent is 59.8 feet per mile for the short tunnel, and 48.4 for the long one. Uniform grades in such country never occur in practice. It is the opinion of Mr. Tinkham that the most difficult grade of the short tunnel will be eighty feet to the mile, and for the long tunnel sixty feet, and these grades only for short distances; and in his conclusion I place great confidence, from the ability and judgment he has shown in the discharge of his duties throughout the exploration.

If the short tunnel should involve but eighty-feet grades, and only for some fifteen miles, it would be better to have additional locomotive power for this small portion of the route, than to be at the expense, in money and time, of the long tunnel. Should the use of the short tunnel involve inclined planes and a large expenditure of stationary power, it will be a question simply of cost, as between it and the long tunnel, as to which shall be adopted. The worst aspect of the case is the practicability of the route only by using the long tunnel, and to this single poiut I shall confine my remarks.

Before entering upon this subject, it may be well to advert to the foot trail referred to in both the reports of Captain McClellan and Mr. Tinkham. It connects Lake Kitchelus with a tributary of the Snoqualme river, and may furnish, though passing over a more difficult and impracticable country, a shorter line to pierce the mountain. In Mr. Tinkham's winter examination, the Indians who accompanied him reported that pass to be better, and more free from snow, than the pass examined. It is more obstructed by fallen timber, and cannot be used with horses.

There has already been a large experience in tunnels, both in Europe and this country. The average cost of tunnels in England has been about £35 per lineal yard. Shafts are sunk from four to six hundred feet. In this country the tunnels on the Baltimore and Ohio railroad cost $260 per lineal yard. A tunnel is being constructed in Massachusetts, under the Hoosack mountains, 24,100 feet long, passing under a country ranging from 300 to 1,700 feet above the line of the tunnel, and the three shafts varying from 300 to 800 feet in depth. A tunnel is now being built in Hungary, ten miles long; and one under the Alps, devised by Mr. Maus, and approved by Stevenson, the great English engineer, seven and two-thirds miles in length, without shafts, the mountain rising 5,000 feet above the line of the tunnel. Mr. Maus proposes to use a machine, and work it by water-power. The grade will be 105 feet to the mile.

Shafts can be sunk in rock about three feet per day. A tunnel without a machine can be pushed three feet from each face per twenty-four hours; and with a machine like that proposed for the Hoosack tunnel, six feet per twenty-four hours; and like that proposed by Mr. Maus, $11\frac{1}{10}$ feet per twenty-four hours.

The proposed tunnel under the Snoqualme Pass will be 11,845 yards in length; in width sufficient for a double track, varying from 22 to 24 feet in the extreme; top semicircular, and extreme height 20½ feet. Five shafts will be required, 333, 604½, 800, 800, and 407 feet, respectively, in depth, and 1,941, 3,882, 5,823, 8,291, and 10,068 yards distant, respectively, from the eastern heading. Allowing one year for locating the tunnel, and one year additional for sinking shafts, it is estimated that it will be completed in four years without the use of a machine, and that its cost will be $130 per lineal foot in round numbers, or $420 per lineal yard. Total cost of the tunnel is estimated in round numbers at $5,000,000.

The line to Seattle by the Snoqualme Pass will cost some seven millions less than the line to the same point by the Columbia river.

The Columbia route from Seattle to the point of junction is estimated to rise seven hundred feet, and to fall three hundred.

The Snoqualme route is estimated to rise in the aggregate for the long tunnel 2,500 feet, and to fall 2,100. Using the formula of Latrobe and Knight, engineers of the Baltimore and Ohio railroad: $\frac{R \times F}{52.8}$ (R being the rise and F the fall,) the equated distance of the line by the Columbia river will be found by adding 19 miles to the measured distance of 395 miles, and that by the line of the Snoqualme Pass by adding 87 miles to the distance of 240 miles—both from the point where the two roads fork. Thus the equated distance of the two routes will be 414 and 327 miles, a difference of 87 miles in favor of the Snoqualme route. With the use of the short tunnel, the difference will be 64 miles. Thus the time gained for passenger trains moving on level grades 30 miles an hour, will be three hours in favor of the Snoqualme route, and six hours for freight trains moving 15 miles an hour. With the short tunnel the gain will be two hours for passenger trains and four hours for freight trains.

It is not believed that any difficulties will occur from snow which cannot easily be guarded against. The climate is mild, the temperature about the same with San Francisco; the harbors are not obstructed by ice, and at the summit level of the route of the Snoqualme Pass the climate is believed to be about the same with that of the summit level of the Portland and Montreal railroad. In January of this year the snow in the pass was only six or seven feet deep for as many miles. For some forty additional miles the snow fell away in depth to less than two feet; it was in layers, very light, and would have offered no obstruction to the passage of cars. In the meteorological portion of the report, the subject will be discussed more at length.

The deepest snow will be over the tunnel, and it will be easy to devise a suitable covering for the few miles from the entrance of the tunnel, which in some seasons may be obstructed.

The general characteristics of the route of the Snoqualme Pass may be summed up as follows: The approach to this pass is by the valley of the Yakima, and the Columbia may be crossed anywhere within fifteen miles above the junction of these two rivers. The approaches to the Columbia are perfectly good, and its width about four hundred yards. No material for building exists immediately at hand. Excellent yellow pine grows abundantly on the Yakima one hundred miles from its mouth, and can be floated down at high water with but little difficulty.

Good granite was found by Captain McClellan on the Columbia, about one hundred and forty miles above the mouth of the Yakima; and Dr. Suckley reports excellent stone for building purposes on the whole line of the Columbia.

From the crossing of the Columbia to the commencement of the pine timber, a distance of ninety-six miles, the general character of the valley is wide, open, and terraced—the ground of sand, gravel, or loose stones; but little clay or vegetable mould; curves easy, long stretches of straight road, perfectly practicable. In this distance there are five points where the hills come close to the river, making at most ten miles of side-cutting necessary. This cutting is generally in earth, loose stone or trap rock, easily broken into blocks. In addition to these points, the last eight miles of the ninety-six will be principally side-cutting in earth, gravel and sand, the work light, and no very high side-slopes. In the first eighty miles from the Columbia the grade will be twelve and a half feet to the mile; in the last sixteen miles it will be eight and a half feet to the mile.

By keeping thus far the north bank of the Yakima, the only bridges of any consequence required will be two over streams each about seventy-five feet in width. At some place in this vicinity it would be advisable to cross to the south bank of the Yakima, which is here about forty yards wide, good crossing easily found, plenty of timber on the spot, and stone for masonry within twenty-five miles by water. The road now keeps to the valley twenty-one miles farther on; four miles beyond Ketetas, passing through an open pine woods; soil light, sometimes gravelly; about two miles side-cutting; grade eight feet to the mile.

If the short tunnel be used, the road must at this point leave the valley, take a side location on the northern slope of the mountain bordering the valley on the south, and ascend eight hundred and ninety-five feet in eighteen and a half miles, giving a grade of 48.4 feet per mile in fifty per cent. rock. The plateau of Willailootzas, one mile long, will be entered by a curve with a radius of about 2,000 feet, the road passing along the north bank of the lake, with side location, in eighty per cent. trap rock, easily worked. This lake should be partially drained; its shores are steep and of broken stone. There will be some little difficulty in preparing a proper depot for the workmen, tools, &c., at the entrance of the tunnel. The tunnel, about 4,000 yards long, will pass through solid rock (silicious conglomerate,) and will debouche on the western slope, at an elevation of about 3,000 feet above the sound at Seattle. The road must now have a side location on the mountain spur bordering the valley of the Nook-noo, in about seventy per cent. rock, generally conglomerate; follow this valley twenty-nine and a half miles, then take the summit and northern slope of the low ridge separating Lake Mowee from the valley of the Snoqualme, and from that taking a spur running from the Nook-noo falls to those of the Snoqualme, reach the latter falls a distance of forty-five miles from the tunnel; all in side-cutting, with rocks as above. The grade will be 59.8 feet per mile. With reference to this stretch of forty-five miles, and that of eighteen and a half miles on the eastern slope, leading to the tunnel, it is to be observed that the grades given above are on the supposition that a continuous grade can be obtained; but it must be expected that the grade will necessarily be broken, and be higher than the estimate in many places.

From the Snoqualme falls to Seattle is a distance of about thirty miles, of which the first ten must have a grade of 20 feet per mile, at most, and the remainder, twenty, pass over quite a level country.

If, instead of a tunnel from the level of Lake Willailootzas, we consider a tunnel from the level of Lake Kitchelus, the case will be as follows: Commencing at the point eighteen and a half miles east of Willailootzas, there will be eighteen and a half miles with a grade of 15.2 feet per mile, and but little side-cutting, through a thickly timbered country as far as Kitchelus. The divide must now be pierced by a tunnel 11,840 yards long, of a character similar to the one considered above. The grade to the Snoqualme falls will be 46.3 feet per mile; all other circumstances unchanged. The greatest grades will probably be 80 feet to the mile in the case of the short tunnel, and 60 feet in the case of the long tunnel, and both for short distances.

A line along the Columbia river to the sound will be necessary, even with lines both down the Columbia river and through the Snoqualme Pass.

Before locating the road, an instrumental survey of the two routes will be indispensable. It is believed that the most unfavorable view is given in the report of the route of the Snoqualme Pass.

The estimates will be given for both routes; and in the estimate for the Snoqualme Pass route, a branch to the Columbia will be included.

CHAPTER XII.

Resumé of the Line from the Base of the Mountains to Puget Sound.

As before observed, the immense prairies, the marked characteristics of the country west of the Mississippi, stretch to the very base of the Rocky mountains, and to this limit a railroad will have no greater obstacles to overcome than the passage of prairie elevations, and the crossing of a few small rivers. It is a singular truth, that while the whole mountain district has a clear breadth by a direct line of 200 miles, the eastern prairies north of the Missouri make up to within fifteen or twenty miles of the summit ridge; and on leaving the prairies and tracing up the several small streams which head in the mountains on the eastern side, one finds himself not only thus suddenly thrown into the midst of the mountains, but that he has hardly crossed their boundary before he has commenced their descent towards the Pacific.

The plains at the entrance to the mountain passes have an elevation of about 4,700 feet above the sea, or are about six hundred feet lower than the tunnel proposed for passing the dividing ridge, and the grade line connecting the two is along the hill-sides at the sources of the tributaries of Beaver creek. The country at this short interval is a good deal broken; the culvert crossings of the several small brooks will be expensive, and the excavations will frequently be rock.

It is estimated that a grade of forty feet can be obtained from the plains to the tunnel.

The Rocky mountain divide, at Lewis and Clark's Pass, is a narrow, sharp ridge, whose extreme elevation is 6,323 feet above the sea, and whose opposite bases, over 1,000 feet below the summit, are two and a quarter miles apart. The passage of this summit is by a tunnel through rock two and a quarter miles long, and at an elevation of 5,300 feet above the sea. The western descent is made with a forty to fifty feet grade. In common with Cadotte's Pass, Lewis and Clark's Pass opens into Blackfoot river, and the routes crossing the mountains by the two passes unite soon after, gaining the river valley on the west side.

Blackfoot river has a generally narrow and wooded valley, the enclosing wooded hills sometimes encroaching upon the river, and sometimes widening and discovering easy-sloping, small, and fertile prairies. The stream itself, from a mountain brook at the summit, ninety-three miles lower down, in the vicinity of Hell Gate, has a width of two hundred feet, and a depth of three feet, flowing over a clear rocky bed. Its bottom is wooded, and the bitter cotton-wood is found mingled with the pines and the different evergreens which make up the exclusive growth of the higher grounds. The valley has an average descent of twenty-two feet per mile.

The bottom-lands of the valley of Jocko river, along whose edge the railroad line is marked, are not generally wooded. The valley from the summit drops down very suddenly towards Clark's fork, facing the line to the wooded hills skirting the eastern side of the valley, and great care will be necessary, in locating the line, to obtain suitable grades. The descent on the eastern side of the valley, which appears most promising, involves the crossing of the main branch of Jocko river at a considerable elevation. A descent on the western side would avoid this, and may be practicable.

Clark's fork, where the line first enters its valley, is from one hundred and fifty to two hundred yards wide—a clear, rapid river, and is rarely fordable. With the exception of the occasional small prairies, serving as camping grounds, and noted on the maps, its valley throughout is heavily timbered, mainly with the pine; cedars of great size are met with in some parts of the valley. At several points on the route the rocky hill-sides crowd upon the river, and all deep cutting will probably expose the rock, apparently mostly species of limestone or trap; but the valley is wider than the valley of Blackfoot river, or of Bitter Root river soon after its junction with the latter stream, and has a general width of two or three miles. The descent of the valley has an average rate of eleven feet per mile.

The greatest gradients of the railroad would not exceed fifteen or twenty feet per mile. After passing from the valley of the Jocko to that of the Flathead, it would follow the hills on the left of that stream to a point some miles above its junction with the Bitter Root; then crossing the former, it would follow the right bank of Clark's fork as far as Big Rock. The course then may either be on the right bank the whole distance to the lower extremity of Pend d'Oreille lake, or it may cross to the left bank at Big Rock, and recross to the right bank at the Cabinet mountain; or, continuing on the right bank to the Cabinet, some twenty miles above Lake Pend d'Oreille, where the river is compressed between walls of solid rock about one hundred feet high, and where the river could readily be spanned by a single arch, it could then cross the river and continue down on its left bank. After reaching the Pend d'Oreille lake it could readily skirt the eastern and southern shore, until it reached a southern prolongation of the lake, which extends about twenty-five miles in the direction of the Cœur d'Alene mission, and from that fact is called the Cœur d'Alene bay. From the upper end of this bay to the Cœur d'Alene lake there is said to be a very gentle rise, and a divide so low that it might readily be passed over by a traveller without notice. From the Cœur d'Alene lake to the valley of the Spokane there is a good natural, almost level grade.

The Cabinet mountain might require tunnelling for three hundred yards, fifty per cent. rock, basalt trap; though, by a careful adjustment of the line of approach, tunnelling may be dispensed with without involving a grade greater than forty feet. Both Clark's fork and the Pend d'Oreille lake are subject to freshets, fifteen feet being about the difference of level between high and low water marks, which would make it necessary that the road should keep the sides of the hill, or that high embankments should be used.

The summit separating Clark's fork and Spokane river, and the summit of the Great Spokane plain, are both about eight hundred feet above the level at which these two rivers are crossed. The opportunities afforded for side-hill location prevent the use of objectionable grades.

The mountain region ends near the crossing of Spokane river.

The earth excavation and embankment will, throughout this section, be large in amount, and expensive. The very best quality of material for a durable road-bed is met with all along the line. The hill-sides discover the disintegrated fragments of the different rocks, and the bottom lands of the rivers afford abundance of gravel for a road passing through them. With the general character of the excavation, and with the opportunities afforded for good ballasting, the road-bed of this section may be of a superior quality.

In all the mountain valleys, the deep side-hill cuttings will frequently expose the rock, and the bulk of the rock excavation in the entire railroad route will be in this section. The tunnel at the Rocky mountain divide will probably be through solid rock, and it is possible that one or two small tunnels may be required at other points.

The approaches to the tunnel at the Rocky mountain divide can be made with a grade of forty feet per mile, and an undulating grade of forty to fifty feet will be required throughout Blackfoot River valley. The ascent from Blackfoot river to the summit divide, between the Bitter Root and Jocko rivers, can be made with a fifty-feet grade, and with great care in the location the descent westward can be made with a sixty-feet grade. This declivity of sixty feet per mile is the highest required in all this section, and in a mountain country cannot be considered a high grade. On this inclination a train can descend with safety without the application of its brake, and without the use of its motive power; so that while there is a loss of power in the ascent, there is a gain in the descent. The natural descent of the valley of Clark's fork, as already stated, is about eleven feet per mile. In general the road need not much exceed this, as in all mountain valleys an undulating grade will be necessary. The passage from the valley of Clark's fork to the Spokane river, and in like manner from the Spokane river to the summit of the Spokane plain, is made with a forty-feet grade.

The bridge and culvert work will be very extensive, and greater in this section than in any other. With the possible necessity of crossing Blackfoot river several times, it includes the bridging of the many small mountain tributaries which make into that river, the crossing of the principal fork of Jocko river, all of them of small volume, but rapid and liable to freshets, and some of them to be crossed higher above their water-level; two, and perhaps four crossings of Clark's fork, with a width of from one hundred to two hundred yards; the crossing of Pack river, a small stream, making into Pend d'Oreille lake, which will probably be with a long causeway, leaving sufficient water-way for the passage of the river, and the crossing of Spokane river. The latter river, where crossed by the train, has a width of one hundred and seventy yards. The bridge crossing will not be so long.

The woods with which this region is covered are a species of yellow pine, of excellent quality for lumber; larch of large size; white cedar of large size; spruces and firs, with a mingling of the bitter cotton-wood in the river bottoms; scattering white birches, and other and smaller trees. For fuel and construction wood is abundant, convenient, and of good quality. I believe that the only coal observed was a single isolated specimen found by Mr. Tinkham, in the bed of a tributary of Clark's fork, and out of place.

Of building-stone the mountain regions contain vast quantities, which undoubtedly will be made accessible when the necessity for their use comes. Perhaps the most convenient and valuable which will be found, are a hard stratified limestone and granite. The first was noticed in the mountains northeast of Flathead lake, but it is probably to be obtained elsewhere, and more conveniently; and the second was observed at the head of Bitter Root river. While the most of the stones exposed in the progress of the excavations may prove unsuitable for building purposes, there is every probability that some of them will be found available for such uses. Good granite is also found on the Columbia.

The limestone referred to is apparently a carbonate, and suitable for the manufacture of lime.

Clear sand is frequently met with on the line. It was observed, in abundance, in the valley of Clark's fork, and it is to be obtained from Pend d'Oreille lake, and elsewhere.

Pure cool water is lavishly supplied by the mountain streams.

The road-way, for nearly the whole of this section, will have to be cleared and grubbed.

With the attainment of the summit of the Spokane plain, or, as I have termed it, the Great Plain of the Columbia, the timbered and wooded country ceases until the line enters the firs of the lower Columbia, two hundred and sixty-five miles farther on. For a while the pine region skirts the route on the east, but in a half day's journey from the summit disappears from view altogether.

The Great Plain of the Columbia, which for about one hundred miles the railroad traverses before striking the Columbia river, resembles a rough, rocky prairie. Descending towards the Columbia, and entering its valley above the mouth of Snake river, the Columbia has a width of from four hundred to four hundred and fifty yards; the banks are low, and the approaches perfectly good. Near this point must deflect any route which, seeking a more direct passage to the sound than is afforded by the Columbia river, shall cross the Cascade range by one of the passes at the head of Yakima river.

On the Columbia the line is for most of the way located on the bottom lands of the river, and will rarely be forced from them to the rocky bluffs bordering its intervale. To the Dalles the bottom lands of the river have a width of from one-quarter to three miles. Bluffs, with a nearly uniform height of one hundred and fifty feet, limit the bottom lands, and are the slopes abruptly terminating a grand plateau of five or ten miles in width, gently sloping to the north, and reaching to a wooded ridge, running nearly parallel with the river. Numerous small streams rise in this ridge, and, cutting the plateau into deep ravines, are eventually discharged into the Columbia. Passing down the Columbia from Wallah-Wallah to the Dalles on the north side of the river, the party of Mr. Tinkham found it necessary in only two instances to cross the rocky spurs jutting out from the river bluffs. The grades for the balance of the route to the sound will be very easy, and the work light; the heavy work being the rock-cutting where the bluffs encroach upon the river, the extra provision needed to preserve the embankments from the wash of freshets, and the possible necessity of a short tunnel at Cape Horn. The bluffy country bordering on the Columbia ceases near Cape Horn. From below the Dalles the woods commence, and so continue to the head of Cowlitz river. The wide and comparatively flat and wooded valley of the Cowlitz connects with plains, sometimes of prairie, and sometimes of woodland, extending to Puget sound, which, although not fully explored, are sufficiently well known to insure the unusually favorable character of the country for the construction of a railway.

The earth excavation and embankment will not probably exceed the heaviest work of the prairies east of the mountains, and is estimated not to exceed an average of seven to eight feet.

The material for the embankment is almost always of a superior character. The Great Plain of the Columbia, and the valley of the Columbia, afford a great deal of loose, pebbly matter from the disintegrated fragments of the trap rock, which will frequently be found to be of much value. Sand in portions of the valley of the Columbia covers extensive plains, and fine gravel plains characterize the Cowlitz valley and the intervale to the sound.

The amount of rock-cutting, with the exception of the portion of the line between the Dalles and Cape Horn, will be very small. A portion of the excavation on the first part of the Spokane Plain will be rock; occasional rock-cuttings will be required in the Columbia River valley, and a small tunnel of seven hundred feet in length may be required at Cape Horn. The rock in this region is generally a basaltic trap.

No grade higher than forty feet will be necessary in this section, and for nearly the whole distance the gradients will be very gentle. The average declivity of the valley of the Columbia is inconsiderable, being less than two feet per mile. Cowlitz river has a small descent per mile.

As a whole, the culvert work will be very small in amount, falling chiefly upon that portion embracing the tributaries of the Cowlitz, and the small streams making down from the western slopes of the Cascades. The great item in bridging is the crossing of the Columbia river, near Wallah-Wallah. But little data is obtained for this crossing; but if the river be bridged near the mouth of Snake river, as indicated on the map, the approaches are here favorable, and the length of the bridge will be about four hundred and fifty yards. Further careful examination is required to determine the best position for the crossing.

The route for nearly one-half of this section is through woodlands; the balance is destitute of wood on the immediate line of the road. The Great Plain of the Columbia, and the Columbia river bottoms as far down as the Dalles, lack wood. Thence forward to Puget sound the route is through heavy forests, principally of the fir and cedar, and abounding with valuable lumber. There will be little difficulty in furnishing the line with all lumber required in its construction. The interval in the Spokane Plain, wholly destitute of trees, is about 110 miles in extent; rests on extensive districts of pine, cedar, larch, &c., at its eastern edge; and on the west, touches on the water of the Columbia, reaching north into a wooded country, and offering easy opportunity for rafting logs and lumber from above.

The wooded ridge beginning at about thirty miles distance from the mouth of Snake river, and running nearly parallel with the Columbia at five or ten miles distance from it, is densely covered with a large growth of timber, probably corresponding with the mixed growth of pines, firs, &c., on the eastern base of the Cascade mountains, with which it finally connects. From the ease with which this growth can be reached from the Columbia, and the facilities afforded by the river for bringing down lumber from above, no difficulty can be felt in supplying the portion of the line on the bottom lands until the wooded lands are again entered near the Dalles.

But little is yet known about the most suitable places for obtaining building-stone. Stone is found in places along the whole line—generally the trap or granite rocks. Probably the only work for which stone will be required, other than such as shall be found near the place of construction, is the bridge across Columbia river, near Wallah-Wallah. Captain McClellan states that "good granite is found on the Columbia about 140 miles above the mouth of the Yakima; it may occur at a less distant point." Dr. Suckley observed good building-stone along the whole line of the Columbia.

Clean sand is noticed near the crossing of Columbia river, and on the bottom lands of Columbia and Cowlitz rivers, and will be obtained conveniently all along the line.

The Spokane Plain, at a few points, is sparingly watered; but there will not be found any difficulty in making suitable provision for water for the use of the road. For the balance of the route this scarcity does not exist, and water is generally quite as abundant as is desirable.

CHAPTER XIII.

Comparison of the Distances on Several Routes.

The several distances to Horse Plain, where the three routes by the Bitter Root river, the Jocko, and by the cut-off from the point of departure in the Blackfoot pass, are respectively 143 miles, 136 miles, and 111 miles. The route by the Bitter Root river will be adopted in subsequent comparisons.

The whole length of this route from St. Paul, by Little Falls, the Grand Coulée, the Milk River valley, the northern approach by Lewis and Clark's Pass, by the Blackfoot River valley, and the three several routes as above, by Clark's fork, the Columbia and Cowlitz rivers, to Seattle, will be 2,052, 2,045, and 2,020 miles, respectively; and by the Yakima valley and Snoqualme Pass, will be 1,897, 1,890, and 1,860 miles. It is probable that further surveys will reduce these distances thirty to fifty miles. By going through the Marias Pass, the distance will be about the same.

A route down the Cœur d'Alene mountains would give, respectively, 1,975 and 1,829 miles.

From Little Falls the distances are—

To Lake Superior	125 miles.
St. Paul	112 “
Chicago	435 “ (via Stillwater and Madison.)

And the distances from Seattle of the two routes to these three points will be, in tabular form, as follows:

	Snoqualme Pass.	Columbia and Cowlitz.
To Lake Superior	1,902 miles	2,058 miles.
St. Paul	1,890 “	2,045 “
Chicago	2,213 “	2,368 “

The following table gives a comparison between the two routes from St. Paul to Seattle, or Puget sound, by the Columbia and Cowlitz, and by the Snoqualme Pass:

	Snoqualme Pass.		Columbia and Cowlitz.	
Length of route	1,890	miles	2,045	miles.
Summit level	5,300	feet	5,300	feet.
Distance when road is 4,000 feet or more above sea	86	miles	86	miles.
Distance when road is 3,000 to 4,000 feet above the sea	206	“	206	“
Distance when road is 2,000 to 3,000 feet above the sea	957	“	932	“
Distance when road is 1,000 to 2,000 feet above the sea	1,692	“	1,564	“
Distance when road is less than 1,000 feet above the sea	174	“	488	“
Length of tunnels	9.32	“ (long tunnel)	2.59	“
	4.86	“ (short tunnel)		
Grades 50 to 60 feet	20	“		
“ 30 to 50 feet	600	“	580	“
“ 0 to 30 feet	1,246	“	1,472	“

It is assumed that any route to Oregon by the South Pass must make the Great Salt lake settlement in its course, descending into its valley by the Timpanogos river, and that it will pass west of the Great Salt lake.

It is not believed that any route will be found leading from the good passes at the sources of the tributaries of the Bitter Root, and those of the Missouri and Yellowstone, and the upper valley of the Bitter Root, to the Little Salmon river, and thence to the Columbia, which will come into competition with that of Clark's fork. It is possible, however, that a route from the western frontier of Missouri and Iowa may be found, which, passing through the Black Hills and one of these good passes, will more readily reach the valley of the Columbia and the waters of the sound than by the South Pass.

Assuming Council Bluffs as the point of departure of such a route, the distances will be respectively to Seattle, by the Columbia river and the Snoqualme Pass, as follows:

	Black Hill and Northern Pass.	South Pass.
Council Bluffs to Seattle, by the Snoqualme Pass	1,997 miles	2,128 miles.
" " by the Columbia river	2,183 "	2,283 "

This examination is an important one, especially if the South Pass prove a difficult and almost an impracticable line. A comparison of the profile of the northern route, and that by the South Pass, establishes the superiority of the former, not only in the lower elevation of the range itself, but of a large space of country adjacent thereto. The information furnished by the surveys of Colonel Fremont and Captain Stansbury makes it probable that the Great Salt Lake valley must be a point of any route to the Columbia river, through the general region of the South Pass, and that it can but be reached by the river Timpanogos, which flows into Lake Utah, at a point about fifty miles south of the Great Salt lake.

The Golden Pass, a pass a few miles to the north, and the Weber river, still farther north, will probably afford practicable passes. It is possible that the valley of the Bear river, as far as Soda springs, (where, from flowing in a direction a little to the west of north, the river turns suddenly to the south,) and thence to Snake river, in the general direction of Fort Hall, would afford a feasible route. The elevation of Soda springs is 5,738 feet above the sea; that of Fort Hall 4,700 feet; the distance is about fifty miles, and an intermediate range, probably at least 500 feet high, would have to be crossed. From the height of the summit, on the direct line to Fort Hall from the Great Salt lake, about 6,400 feet above the sea, a route in this general direction would be difficult. It will require thorough examinations in subsequent surveys, and is alluded to in this connexion in explanation of my adopting the Great Salt Lake valley as a point of the route. The river Timpanogos is adopted as the best entrance into the valley.

The importance, however, of the Great Salt Lake settlement as a point in the communication across the continent cannot be over-estimated, and the feasibility of routes through that region both to San Francisco and Puget sound should be ascertained by actual examination.

Before proceeding to the plan of construction, and other matters of a general character, I will endeavor to show that no obstructions need be apprehended from snow, and at a subsequent part of my report I will allude to the governmental measures required to guard against the hostilities of the Indian tribes.

CHAPTER XIV.

Meteorology of the Field Explored.

The meteorology of the field covered by the exploration is one of the most interesting, as it is one of the most important subjects of inquiry. It is not obstructed by deep snow, nor is the temperature as low as has been generally imagined. There is a great depression in the whole mountain chain of the Rocky mountains, the higher plateaus being nearly three thousand, and the lower two thousand feet above the sea; whereas, at the 41st parallel, the higher plateaus are six thousand, and the lower and more general ones are four thousand five hundred feet above the sea. The greatest elevation of the Rocky mountains is south of the South Pass, in latitude 39° to 40°, where the Platte, the Rio Grande, the Arkansas, and the Colorado of the Gulf of California have their rise. The mountain chain then rapidly declines to near the 48th parallel. The temperature of the Rocky mountains at this parallel is as mild as any part down to the 35th parallel of latitude. Moreover, on the western coast, the prevailing westerly winds and the currents of the Pacific ocean, similar to, though less known than the Gulf Stream, have modified the climate to such a degree that the isothermal lines run nearly parallel to the coast, making the climate of Puget sound nearly if not quite as mild as that of San Francisco, and causing it to correspond with that of the western coast of Europe in the same latitude. Puget sound and Vancouver's island are strikingly like Ireland and West Shetland in temperature; the first locality having a mean temperature for July of 65°, while Dublin has but 60°, and the British islands range from 57° to 63°. At Sitka, in Russian America, the mean of winter at 35°, and the summer mean of 56°, correspond to the north of Ireland and Scotland. The effect of this amelioration of temperature not only extends to the Rocky mountains, but is felt on the eastern slope and for some distance on the plains, where, in turn, it is met by the temperatures from the Atlantic sweeping over the vast interior continental areas, growing somewhat colder till the western end of Lake Superior and the Red river settlement of the north is reached, and then growing milder till it meets the temperatures from the Pacific at an equilibrium.

As regards the distribution of rain and snow, much of the moisture is deposited before reaching this high latitude, except on the coast, where there is a large local precipitation; and the Cascades mountains of Oregon and Washington arrest much of the rain that would be distributed farther in the interior, especially in winter; and, as a consequence, the Rocky mountains in that latitude have little winter precipitation, and the plains eastward have still less. The general plateau from the head of the Mississippi westward, to and including the Rocky mountains, has indeed the least winter precipitation of any portion of the continent, and can furnish no accumulation of snow from the two or three inches of water falling in a frozen state in the winter months.

The latitude is too high up for a large amount of precipitation, except near the coast. The great summer precipitation of the upper portion of the Mississippi valley shows the line of profuse rains to be at its farthest point northward there at that season of the year. On the plains it extends farther north into British America, and on the coast of the Pacific it stretches from Sitka northward nearly over the whole line of the coast.

From these general facts of distribution of the water falling in rain and snow in the extreme seasons, the observed facts of the winter climate of the interior are seen to have merely their natural place. Little accumulation of snows can exist in the interior of these latitudes, at whatever elevation; and none of the elevations are such as to give extreme temperatures, or to break the force of the general modifying influences here referred to.

With but few results of recent observation in the shape of mean temperatures, or measures of amount of rain and snow, a few statements comprising such stations as have been observed are given in a tabular form. Their general significance may here be mentioned. In the first, the mean temperatures for the last five years are given at the stations most nearly in a line from Fort Snelling westward. In this series Fort Clark and Fort Union, of the Missouri, are given as observed at an earlier date, as no recent observations are at hand from these posts, and they are much needed to fill up the line. The observations at Fort Benton of December, and those of the St. Mary's valley of January and February, are combined; the remaining observations, though made and their general character known, not being at hand.

It will be seen that the mean temperatures increase rapidly westward for all parts of the year, except the summer months, though the latitude constantly increases, and the elevation also, except at the immediate coast of the Pacific. Thus, for the winter months, five years' observations at Fort Snelling, one year at Fort Clark, (two months' observations,) one winter at Fort Union, one winter at Fort Benton and St. Mary's, three winters at Lapwai on the Kooskooskia river, we have—

Fort Snelling, latitude 45°	temperature	13° 3
Fort Clark, latitude 47°	"	14°.5
Fort Union, latitude 48°	"	23°.8
Fort Benton, latitude 47° 26′	"	26°.1
St. Mary's, latitude 46° 30′	"	26°.1
Lapwai, latitude 46° 30′	"	36°.9

Fort Benton will be a little colder, and St. Mary's milder.

In the second table, extremes of temperature for each month of 1853, and for three months of 1854, are given. These follow the same law.

In the third table, winter temperatures are compared for the last three winters. In this table Milwaukie, Buffalo, and Boston are added, to extend this comparison through known districts to the Atlantic. The lowest winter temperatures are at Fort Snelling; and the line extending westward from this point has higher temperatures than that extending eastward to the Atlantic, and this by a large measure of difference.

Another comparison is made of stations on the meridians of the Rocky Mountains plateau. These are detached and few, but they show striking uniformity of winter temperatures over the whole plateau, though the extreme points thus compared differ by twelve degrees of latitude.

In a general table the amount of precipitation in rain and snow is given, for a series of stations, in the line of the first temperature comparisons. Fewer stations are embraced than in the first case, and Fort Laramie, in latitude 42°, is used as a representative of the district of the upper Missouri. It differs only in giving a larger precipitation than is found northward in the same longitudes. An important point of comparison here is wanting, in measuring the contrasts in precipitation of the mountain regions in different latitudes. Observations of a general character supply some facts here, but there are no precise measures. The general laws of climatology before referred to embrace all that may be properly introduced here. These results have been arrived at by combining with the observations of the exploration those of the Smithsonian Institution, and those of the military posts reported to the Surgeon General's office. With these general observations, I will proceed to give a more particular view of the manner in which the meteorological field was occupied, and of the results which have been established.

For these tables, and for valuable suggestions in reference to the climatology of the region traversed, I am indebted to Professor Blodget, of the Smithsonian Institution.

The observations for altitude, by the barometer, were made throughout the day at each characteristic change on the base-line of the survey, and at important points off the line, to gain the contour of the country. Each engineer party was provided with its barometer, and careful comparisons were made at night. Occasionally the results were tested by the usual levelling instrument. Fixed stations were established at Fort Benton, Fort Union, and Cantonment Stevens in the St. Mary's valley, at Vancouver, and at Olympia. Observations were also made for comparison at Fort Snelling and St. Louis. The final discussions will be made by the officers of the Smithsonian Institution, and in connexion with the large body of observations made in all parts of the country under their direction.

30.00 is assumed as the altitude of the mercurial column at the level of the sea for the work of the portion east of the Cascades; and a fraction over thirty inches, the result of five months' observation at Vancouver, for the altitude at that place. It is believed the results given in the profiles will be found sufficiently near the truth, in the final discussion, to be relied on in the preliminary computation.

Much attention has been given to ascertain the circumstances of the snows and freshets of the whole country passed over, both by inquiries from all reliable sources and from actual observation by winter parties. I am able to give conclusive reasons to show that no obstructions whatever need be apprehended from snow at any point of the route. From the plateau of the Bois de Sioux and the Red river of the North to Lake Superior, two feet is a large quantity of snow, though winters have been known when the snow was considerably deeper. The winters are dry, the weather clear and bracing, with little or no wind. The mercury, though occasionally it falls to a very low point, is seldom below zero. The coldest day of the winter of 1852–'53, February 8, the mercury fell to 25° below zero, and the winters are from four to four and a half months long. Frosts seldom occur before October. The fall climate is remarkably fine.

The Hon. H. M. Rice, the delegate from Minnesota, has often travelled in winter from St. Paul to Crow Wing, a distance of one hundred and fifty miles, with a single horse and sled and without a track, and has never found snow deep enough to impede his progress. From Crow Wing he has gone to the waters of Hudson's bay on foot, without snow-shoes. During one winter he travelled through that region, finding the snow seldom over nine, and never over eighteen inches deep. For several years he had trading-posts extending from Lake Superior to the Red river of the North, from 46° to 49° north latitude, and never found the snow too deep to prevent supplies from being transported from one part to another with horses. One winter, north of Crow Wing, in latitude 47°, he kept sixty head of horses and cattle without feed of any kind, except what they could procure themselves under the snow. Voyageurs travel all winter from Lake Superior to the Missouri with horses and sleds, having to make their own roads; and yet, with heavy loads, are not deterred by snows. Lumbermen, in great numbers, winter in the pine regions of Minnesota with their teams; and the snow is never too deep to prosecute their labor. Occasional winters the snow is not over six inches deep. The average close of navigation of the upper Mississippi for the last five years is November 26, and the average first spring arrival April 8.

The Hon. H. H. Sibley, the last delegate from Minnesota, also a most experienced voyageur, states that the snow seldom exceeds fourteen or fifteen inches, and he has known two or three winters in succession when there was not snow enough for tolerable sleighing.

Alexander Culbertson, Esq., the great voyageur and fur-trader of the upper Missouri, and who for the last twenty years has made frequent trips by land from St. Louis to Fort Benton, has never found the snow drifted enough to interfere with travelling. The average depth of snow is twelve inches, and frequently the snow does not exceed six inches.

The letter of Mr. Rice and extracts from those of Mr. Sibley and Mr. Culbertson are appended, for a more full view of the winter climate of the region.

At St. Paul, the coldest days of six winters are as follows:

1845–'46	below zero	18°
1846–'47	"	27

1847–'48	below zero 28°
1848–'49	" 37
1849–'50	" 31
1850–'51	" 32½

At Pembina, on the Red river of the North, and just under the 49th parallel, the winter climate is somewhat colder than at St. Paul, the mercury freezing once or twice during each winter. The spirit thermometer has shown a temperature of 52° below zero. The navigation of the Red river closes from the 1st to the 15th November, and opens from the 10th to the 25th of April.

Westward to the Rocky mountains, the climate becomes milder and the quantity of snow is less. In the immediate vicinity of Fort Union, the fall of snow is light; and the Missouri generally freezes from the 20th of November to the 1st of December, and breaks up about the 1st of April. Through the courtesy of the officers of that post, observations of the temperature, and of the occurrence of ice and snow, will be kept for many months, which will hereafter give the means of developing still further the meteorology of that region.

At Fort Benton the climate is comparatively mild. But little snow falls, and the Fur Companies who have occupied that position for twenty years always carry their goods to their trading posts in winter, on the Milk and Marias rivers, in wagons. They have a post on the Milk river and at the forks of the Marias, the former about seventy-five miles from Fort Benton, a little to the east of north, and the other about one hundred miles in a north-northwest direction. Even on a line much farther north, the quantity of snow is not excessive. Thomas Simpson, from December 1, 1836, to February 1, 1837, made a journey of 1,277 miles, on a route between latitudes 50° and ———, from the Red river to Fort Chipewayan, on Lake Athabasca, taking in his route Forts Pelby and Carlton. The weather was mild till December 16, and no snow of consequence was on the ground till December 14. At Fort Pelby, near the source of the Assiniboin river, the temperature on December 19th fell to 44° below zero. The route to Carlton, which was reached on the 30th December, was over a rolling country, affording food at times to countless herds of buffalo, the weather being intensely cold. Thence to Fort Chipewayan the route was through a wooded and most picturesque country, the weather at times mild and rainy, the snows of the valleys soft, and the depth at Lake Athabasca about three feet. The probable depth from Fort Carlton to this point was from two to three feet.

I experienced great difficulty, both at Fort Union and Fort Benton, in getting information as to the snows in the passes of the Rocky mountains, and as to the period when they were practicable for horses. Even at Fort Union the employés of the expedition were disturbed by assurances from the half-breeds in that vicinity, that they would find the snow knee-deep before reaching Fort Benton, and that the Rocky mountains would be impassable.

At Fort Benton most diligent inquiry was made of the members of the Fur Companies and of the Blackfeet Indians. No person was found who had ever crossed the mountains later than the first days of November, or earlier than the first days of April. The general opinion was that the snows were some twenty feet deep from November till April, and sometimes till May. But as no person could speak from positive observation, it became necessary to determine the question experimentally.

Winter posts were therefore established at Fort Benton and in the St. Mary's valley, under the direction of Mr. James Doty and Lieutenant Mullan, and, in accordance with his own original suggestion, Lieutenant Grover was directed to leave Fort Benton in January, and cross the ranges to the Pacific with a dog train.

On reaching the St. Mary's valley, information was received from the Flathead Indians that the passes were generally practicable with horses throughout the winter. There has been no communication whatever between Fort Benton and the St. Mary's valley. The Flatheads never visit Fort Benton, and the Blackfeet Indians go to the valley only to steal horses. Victor, the Flathead chief, assured me that his people always recrossed the mountains in December or January, generally between Christmas and New Year—men, women, and children—with their horses laden with meat and buffalo robes. It was only in a winter of extraordinary severity, and at rare intervals, that they could not cross in January and February. I also learned that the Washington Territory Indians went to the hunt in October and November, and returned in February and March. This information has since been confirmed by myself and the gentlemen of my party meeting many hundreds of these Indians on their way to the plains, and ascertaining from them and the fathers of the mission their customs in this respect.

In order to give as wide a range as possible to the general field of exploration, and to accumulate information on this interesting question, Mr. Tinkham was sent back to Fort Benton with orders to return by a more southern trail to the St. Mary's valley, and thence to take the southern Nez Perces trail to Wallah-Wallah, and thence by the military road over the Cascades to Nisqually. This last order was modified, and he was directed to cross the Cascades by the Snoqualme Pass.

Expresses were also sent from the Columbia, by Clark's fork, to the St. Mary's valley, through the winter, and the condition of the snows ascertained during December, January, and February.

The results may be summed up as follows: In the Rocky mountains the greatest average depth of snow found by Lieutenant Mullan, from the 28th of November to the 10th of January, was only twelve inches, and that only for a short distance over the divide. On the divide from the Jefferson fork to Snake river the snow, though only twelve inches deep, was occasionally drifted from two to three feet deep.

In this period he made an exploration to Fort Hall, going and returning on different routes, crossing the mountains four several times, and making an aggregate distance of more than seven hundred miles. The mountain region thus crossed was from the forks of the Missouri to the Hell Gate river. On the divide leading to the Hell Gate river, there was but two inches of snow on the 31st of December. I will call attention to the circumstance that, on the divide from the Three Forks to the Salmon river, Lieutenant Mullan's guide found but three feet of snow in the winter of 1852-'53—a season remarkable for the great quantity of snow which fell—and that he crossed it in the winter with his horses.

The grass, except from the Snake River divide to Fort Hall, was rich and luxuriant in the valleys. The weather was as cold as in many parts of the New England States; the thermometer falling in some cases to 28° below zero.

On the 27th of January Lieutenant Mullan writes me that Victor, with the Indians of his own and other tribes, were crossing the mountains from the buffalo plains.

In March Lieutenant Mullan went to Fort Benton by the southern and Little Blackfoot, and returned by the northern Little Blackfoot Pass, finding but ten inches on the first pass and no snow on the second pass.

Lieutenant Grover, after his survey of the upper Missouri, remained at Fort Benton through the month of December, during which month the Missouri had been obstructed only a day or two with ice. He left Fort Benton on the second day of January, no snow having fallen till the previous evening, and crossing the divide by Cadotte's Pass he found but one foot of snow on the divide and on the Blackfoot trail; thence to Wallah-Wallah, which he reached on the fourth day of March, he found little or no snow in the valleys and on the prairies till he reached Thompson's prairie, on Clark's fork. From this point his course was through a densely wooded country, and the snow gradually increased in depth till at the distance of fifty miles it reached the depth of two feet, and remained about this depth till within a few miles of the Pend d'Oreille lake, where it began to decrease, and in the immediate vicinity of the lake was only one foot deep. On the shores of the lake the snow continued to decrease, and occasionally a fine field of grass was found. From the crossing of Clark's fork to the Cœur d'Alene prairie, a distance of sixty miles, the route was through a wooded country, and the snow was two and a half feet deep and very hard. On leaving the forest for Cœur d'Alene prairie, the snow disappeared, the grass was good, and no difficulty whatever was experienced in reaching Wallah-Wallah. I will call attention to the influence of the forests in preserving the depth of snow, and to its entire disappearance, from being two and a half feet deep, immediately on reaching the prairies, and this on the 23d of February. On this same route, in January the snow was, in the woods, not over one and a half foot deep, and there was little or no snow on the prairies. A track opened for a wagon or a railroad, would not have been encumbered at any point with over a foot of snow the entire winter.

In this connexion it will be well to advert to the large quantities of horses and cattle at Fort Benton, in the St. Mary's valley, and in the several prairies on Clark's fork, which are alluded to by Lieutenants Grover and Mullan as being fat in the middle of winter.

The average temperature found by Lieut. Grover from January 2d to January 11th, before leaving the plains to ascend to the dividing ridge, (he reached the ridge at noon January 12th,) ten days, was 20°.9; and whilst going through the pass to the Bitter Root valley, from January 11th to January 21st, eleven days, was 10°.4 below zero. From January 31st to March 2d, on his journey to Wallah-Wallah, the average temperature was 33°.3.

It must be remarked, however, that Lieut. Grover crossed the divide and was in the pass during the coldest weather of the winter; that on the 22d day of January, after entering the St. Mary's valley, the thermometer at sunrise was only 1° above zero, while at about the same point on the 31st of January it was, at sunrise, 55° above zero, and at Cantonment Stevens it ranged, from January 27th to January 31st, from 29° to 46°.

That Lieut. Grover crossed the divide at the coldest season is confirmed by corresponding observations at many other points. The period of greatest cold marched steadily eastward last winter, it requiring some four or five days to reach the Atlantic from the head of the Mississippi, and six days from Fort Benton.

The following tables of comparisons, both for the cold period of eleven days in the pass and for the comparatively mild period of ten days approaching the pass, show that the temperature of the pass was 6°.6 milder than that of Pembina, but $\frac{9}{10}$° colder than that of Lacquiparle, and some 7°.4 colder than that of Oldtown, Maine; and that the temperature of the plateau reaching from Fort Benton to the pass was 2°.6 milder than the corresponding mild period of the same stations, stretching from the Red river of the North to Nova Scotia. In the appendix will be found a temperature chart illustrative of these facts.

Comparison of eleven days crossing the Rocky mountains with the corresponding temperatured periods in a line towards the Atlantic:

Crossing the Rocky mountains	12th to 22d	January,	—10°.1
Pembina, Red River valley	13th to 24th	"	—17°.7
Fort Ripley	14th to 24th	"	—14°
Lacquiparle, Minnesota	14th to 24th	"	— 9°.2
Fort Snelling	14th to 24th	"	— 9°.3
Madison, Wisconsin	16th to 25th	"	+ 4°.4
Fort Ridgeley	14th to 24th	"	— 7°.3
Pittsburg	14th to 24th	"	+23°
Rochester	16th to 25th	"	+21°.8
West Point	16th to 25th	"	+25°.8
Amherst, Massachusetts	17th to 26th	"	+20°.7
Oldtown, Maine	18th to 28th	"	— 2°.7
Albion Mines, Nova Scotia	18th to 29th	"	+ 7°
Montreal	18th to 29th	"	— 1°
St. Johnsburg, Vermont	18th to 29th	"	+ 1°.1

Comparison of ten days before reaching the summit with the corresponding temperature periods eastward:

Between Fort Benton and the Rocky mountains	2d to 11th	January,	+24°
Pembina, Red River valley	3d to 12th	"	+ 5°
Fort Snelling	4th to 13th	"	+ 7°.7
Fort Ripley	4th to 13th	"	+ 3°.9
Lacquiparle, Minnesota	2d to 12th	"	+13°.6
Fort Ridgeley	4th to 12th	"	+ 8°.5
Madison, Wisconsin	4th to 13th	"	+17°.5
Pittsburg	4th to 13th	"	+32°.4
Rochester	4th to 16th	"	+30°.4
West Point	5th to 16th	"	+32°
Amherst, Massachusetts	6th to 16th	"	+27°.4
Oldtown, Maine	6th to 18th	"	+14°.2
Albion Mines, Nova Scotia	6th to 18th	"	+20°.4
Mean			21°.4
			24°.0
			2°.6

Mr. Tinkham met with no snow on the Marias Pass till the day aftercrossing the divide, October 21st, when a few inches fell. His course back was by the Little Blackfoot trail, and the snow was about an inch or two deep in the divide. On the southern Nez Perces trail over the Bitter Root mountains, the snow was six feet deep for one hundred miles or more. This trail is from one hundred to one hundred and fifty miles south of the railroad line. This depth of six feet occurred in December, when there was but twelve to fifteen inches in the passes of the Rocky mountains, the divide being at least 7,500 feet high, and it covered a much greater extent of country. The snows are of an entirely different character, being wet and compact, and the temperature much milder than in the Rocky mountain divide.

Mr. Tinkham's passage of the Cascades on the 21st January furnishes the only observations we possess as to the depth of snow in that range. Crossing after mid-winter, he found for six miles the snow six feet deep, with occasional depths of seven feet, as also of four feet. For twenty additional miles the snow was from four to six feet deep, and for twenty-five miles more, two to four feet. Of this depth one and a half to two feet fell on the night of the 19th and 20th January, so that in mid-winter the snow was but four to five feet deep in the divide. This snow was very light, in layers of one and a half to two feet, and Mr. Tinkham is of opinion that the rains of February would tend to make the snow more compact, so that the depth would diminish, notwithstanding more snow fell, making the pass practicable in March. I will particularly refer you to his report for the details of his interesting trip, and the conclusion which his judgment has reached in this question. I discredit the evidence of Indians, except when they have actually made personal observations. The Indians cannot be competent witnesses as to the snow being six or ten feet deep in one place, or twenty to twenty-five feet in another, lying in their lodges as they do all winter, and seldom ever using snow-shoes at all. Early in January the Indians at the Snoqualme falls were of opinion that the snows in the pass were twenty to twenty-five feet deep, where, according to Mr. Tinkham's measurements, making the allowances for the intermediate fall of snow, it could not have exceeded four or five feet. Among the Yakimas, Mr. Tinkham was hardly able to get shoes enough for his party, and none were found among the Snoqualme Indians on the other side. It was with difficulty he could get guides, and was in consequence detained two days; yet he was assured by them that the snow in the pass would only be up to, or perhaps a little above, the head of his horse, and he got the impression from them that there was more snow than usual.

I have no question that there are exceptional winters, when the snow may for short distances considerably exceed the depth found this winter. But it will require the combination of some two months' weather much colder, and moisture more excessive, than the average. Thus the last two winters have each given only one cold month—January last winter, and February the winter before. About the same quantity of rain and snow fell each month, viz: eight inches and a fraction; much of it was no doubt deposited in the pass in snow. I am of opinion, however, that even in these months some rain fell in the pass, and that in the remaining months of these years it fell principally in rain. I am aware that the quantity of moisture at Steilacoom is not the measure at the pass, where it must be much less. These observations are conclusive, however, relatively, as they determine the quantity of moisture deposited in the sound, to which the moisture in the pass must have definite relation. It will be interesting to continue these observations through a term of successive years.

The experience of Fort Benton and St. Mary's valley is full of significance and instruction. I am assured by Mr. Pambrun, the chief clerk in charge of the Wallah-Wallah post, that his father took a band of horses through the Nahchess Pass about Christmas, some years since, and I interrogated one of the employés at the post, who actually accompanied Mr. Pambrun, sr., on the occasion. I am informed by respectable gentlemen on the sound, that it is no uncommon thing for the Indians to cross the Snoqualme Pass with horses in mid-winter. At all events, the Indians who accompanied Mr. Tinkham in January, made their arrangements to recross the pass in February. They cached their snow-shoes at the upper end of Nook-noo lake, eighteen miles west of the summit, thus showing that they did not expect much increase of snow, and they desired to take the foot-trail referred to by Captain McClellan, assuring him there would be less snow than in the usual horse-trail. Moreover, there is every reason to believe that the snow was in unusual quantities in the cascades the last year. It is well known that a much larger quantity of snow was deposited on the shores of Puget sound. Careful observations of the temperature, and of the amount of water falling in rain and snow, have been taken for a consecutive period of five years at Fort Steilacoom, and the result has been that more water was deposited the last year than the average of five preceding, but that more must have been deposited in snow. A comparison of the three winter months, for the past five winters, shows, at Fort Steilacoom, a deposit of 20.68 inches the last winter, against 20.22, 20.86, 19.39, and 22.10, for four previous winters: adding the month of November, it shows 39.09 against 26.39, 23.88, 24.53, and 31.52; or throwing out February, in order to bring the comparison as near as practicable to Mr. Tinkham's crossing of the pass, we have 31.52 this year against 23.15, 18.45, 23.06, and 26.69. The average temperature of the three winter months is 38.3 for this year, against 37.3, 43, 39.6, and 37.1, of previous years; and for the three months, November, December, and January, we have 40.1 this year, against 40.3, 44.1, 40, and 40, of previous years. The moisture is in great excess, nearly fifty per cent., and the temperature is slightly below the average. In November last the mean temperature was but $\frac{8}{10}$ of a degree greater than in December. It is true that in February of this year there was nearly as much moisture deposited as in January, and the temperature was only 1°.3 above the average of the three months. It is greater than that of January by 9°, and less than the average of November and December 5°.3. A greater proportion of snow necessarily fell in that month than in November and December. Moreover, the experience of the survey of Clark's fork corroborates this.

Excepting for about six or seven miles, the Snoqualme Pass is at a much less average elevation than the route from Thompson's prairie to the Cœur d'Alene prairie; and being in close vicinity to the waters of the sound, the temperature must be higher. The average temperature down Clark's fork, where the snow was met with, from Thompson's prairie to Pend d'Oreille lake, and from the crossing of Clark's fork to the Cœur d'Alene prairie, was about 32°; whereas during the same period, February 7 to 15, and February 19 to 24, the average temperature of Puget sound was about 42°; yet the snow in Clark's fork increased nowhere more than one foot, and that uniformly in the wooded portion of the route. While these are the probable conclusions from what is known, the question ought not to be considered settled till further examinations are made.

But I have no question that much of the moisture in all the winter months is deposited in rain in the mountain passes; and this conclusion must be reached by every observer of the effect of the warm rains of the winter on the surrounding mountains, causing in November, in December, and in February (I speak of what was observed last winter) large masses of snow entirely to disappear. The mountains change from day to day. The whole surface of the mountain slopes will be covered one day with snow, and the next large portions will disappear, in consequence of the genial rains.

I much regret that Lieutenant Grover did not receive my orders in time to go through the pass in March.

I have thus fully gone into the reasons which have convinced me that there will not be sufficient snow in this pass to obstruct the passage of cars, and that frequently the pass is practicable for horses all through the winter. I believe a wagon-road can be used through that pass with but little labor all winter. It seems to me that the conclusions to which I have come, from actual observations, are to be drawn; from the extreme narrowness of the mountain range at the pass, only about seven and a half miles; from its absolute altitude, only 3,500 feet, being more than 2,388 feet above Vancouver; from the open character of the valleys on both sides; and from the mild character of the climate of Puget sound, in close proximity, causing much of the moisture to be deposited in rain. Should the grades be found good on the western slope, of which I am confident, the Snoqualme Pass must furnish the entrance to the sound of the trunk line of the northern route; and it becomes important, to satisfy the skeptical, to test thoroughly the questions of snow as well as of grades. In the event of the continuation of the survey, I would recommend establishing a winter post near that pass. At all events, it is unquestionable that no obstructions from snow exist in the passes of the Rocky mountains, and of the route of Clark's fork, the Spokane plain, the Columbia and Cowlitz valleys, to Puget sound.

For more information in reference to this subject I will refer you to Lieutenant Grover's report of his winter trip from Fort Benton to Wallah-Wallah, marked I 36; to Mr. Tinkham's report, marked I 37; and to Mr. Mullan's report of his reconnaissance to Fort Hall, marked G 25; as also to the letters of Mr. Rice, Mr. Sibley, and Mr. Culbertson, marked I 38, in the appendix.

No. 1.—MEAN TEMPERATURE FOR EACH OF THE LAST FIVE YEARS.

Fort Snelling—latitude 45°.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
1849..	5.4	15.5	30.2	39.7	54.8	68.2	71.6	63.8	61.5	47.2	41.6	8.5	41.6	67.9	50.1	9.8	42.3
1850..	14.0	18.3	24.2	37.0	55.1	71.0	76.6	74.3	60.8	49.4	33.7	12.5	42.1	74.0	48.0	14.9	44.7
1851..	14.9	22.1	39.4	50.1	57.9	67.8	76.3	68.4	69.1	52.0	30.1	10.7	49.1	70.8	50.4	15.9	46.6
1852..	12.7	23.1	26.5	42.1	58.2	68.5	72.7	71.0	53.8	52.7	25.5	11.8	42.3	70.7	44.0	15.9	43.2
1853..	15.2	6.7	23.0	46.9	53.9	67.6	70.6	71.3	60.0	45.6	29.6	18.2	41.3	69.8	45.1	13.4	42.4
1854..	1.3	15.4	30.7	48.6	......	......	......	......	......	......	......	......	......	......	......	......	.....
Mean.	10.6	16.8	29.0	44.1	56.0	68.6	73.6	69.8	61.0	49.4	32.1	12.4	43.0	70.7	47.5	13.3	43.6

No. 1—Continued.

Fort Clark—latitude 47°.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
1833..	......	......	......	......	......	......	......	......	......	......	32.9	21.3	......	......	......	......	.....
1834..	—5.5	23.8	25.1	......	......	......	......	......	......	......	......	......	......	......	......	......	.....

Fort Union—latitude 48°.

1832..	......	......	......	52.0	47.5	66.2	73.8	......	......	......	......	......	......	......	......	......	.....
1833..	21.3	17.5	32.5	47.8	52.1	65.8	73.5	70.6	58.4	......	......	......	44.1	70.0	......	......	.....

Fort Benton—latitude 47° 20′.

1853..	......	......	......	......	......	......	......	......	......	53.3	19.4	33.0	......	......	......	......	.....

Cantonment Stevens—latitude 46° 30′.

1854..	13.9	31.3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	.....

St. Mary's Village—latitude 46° 30′.

1854..	......	35.4	......	......	......	......	......	......	......	......	......	......	......	......	......	......	.....

Lapwai, Kooskooskia—latitude 46° 30′.

1837..	32.5	37.5	43.2	56.0	61.0	67.7	68.2	71.0	60.0	48.2	41.5	40.0	53.4	69.0	50.0	36.7	52.3
1840..	38.0	41.5	42.2	49.5	54.0	70.0	72.0	73.0	68.0	48.0	41.5	40.8	48.6	71.7	52.5	40.1	53.2
1841..	25.0	36.5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	.....
Mean.	31.8	38.5	42.7	52.7	57.5	68.9	70.1	72.0	64.0	48.1	41.5	40.4	51.0	70.3	51.2	36.9	52.3

MEAN TEMPERATURES AT STATIONS IN THE NORTHWEST.

Steilacoom, Puget sound—latitude 47°.

1849..	.....	......	......	......	......	......	......	......	......	......	48.1	36.1	......	......	......	......	.....
1850..	35.7	39.4	41.2	47.7	56.3	60.6	64.8	62.9	55.5	51.9	41.9	37.4	48.4	62.7	49.8	37.5	49.6
1851..	40.6	40.8	43.2	51.5	54.4	61.2	63.9	66.3	57.0	52.9	47.0	41.1	49.7	63.8	52.3	40.8	51.7
1852..	44.1	43.7	40.9	46.5	58.2	62.1	64.4	64.6	56.6	51.9	48.9	32.2	48.5	63.7	50.8	40.0	50.8
1853..	39.7	39.8	41.9	48.7	57.6	60.4	66.5	62.1	58.5	53.6	45.2	44.6	49.4	63.0	52.4	41.4	51.5
1854..	30.6	39.6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	.....
Mean.	38.1	40.7	41.8	48.6	56.6	61.1	64.9	64.0	56.9	52.6	46.2	38.3	49.0	63.3	51.9	39.0	50.8

Fort Vancouver—latitude 45° 36′.

1849..	.....	......	......	......	......	......	......	......	......	......	......	35.3	......	......	......	......	.....
1850..	38.5	38.3	42.0	57.8	62.1	62.2	68.5	67.2	61.6	64.5	43.7	36.1	44.0	65.9	53.3	37.6	50.2
1851..	......	......	......	......	......	......	......	......	......	......	......	38.2	......	......	......	......	.....
1852..	44.6	44.3	42.8	48.8	60.9	72.6	......	......	......	54.0	45.1	33.0	50.8	......	......	40.6	.....
1853..	37.8	42.1	46.5	54.2	60.0	63.3	70.8	64.0	60.3	53.5	45.4	41.8	53.6	66.0	53.1	40.6	53.3
1854..	.....	38.0	45.0	......	......	......	......	......	......	......	......	......	......	......	......	......	.....
Mean.	40.3	40.7	44.1	50.3	61.0	66.0	69.7	65.6	61.0	54.0	44.7	36.9	51.8	67.1	53.2	39.3	52.8

No. 1—Continued.

Dalles of Columbia—latitude 45° 40′.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
1850..	.....	......	......	......	......	......	......	......	57.1	53.4	38.2	31.3	......	......	49.5	......	.....
1851..	37.9	41.4	46.7	......	......	......	......	......	......	......	......	.....	......	......	......	......	.....
1852..	.....	......	......	......	......	......	......	......	......	54.1	42.2	26.1	......	......	......	......	.....
1853..	32.3	37.1	43.7	53.4	62.1	66.6	74.9	70.2	63.7	55.3	42.1	40.1	53.1	70.6	53.7	36.5	53.5
1854..	22.0	38.9	46.0	......	......	......	......	......	......	......	......	......	......	......	......	......	.....
Mean.	30.7	39.1	45.5	53.4	62.1	66.6	74.9	70.2	60.4	54.3	40.8	32.5	53.7	70.6	51.8	34.1	52.5

Fort Hall, Cantonment Loring—latitude 43°.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
1849..	.....	......	......	......	......	......	......	63.4	59.6	47.9	34.7	22.5	......	......	47.4	......	.....
1850..	24.3	24.1	25.2	42.7	......	......	......	......	......	......	......	......	......	......	......	......	.....

No. 2.—EXTREMES OF TEMPERATURE OBSERVED IN 1853—LOWEST OBSERVATIONS.

Place.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Fort Snelling	—15	—24	—15	14	34	47	54	43	40	8	3	—16
Fort Benton	......	......	......	......	......	......	......	......	......	11	—2	+0
Dalles of Columbia	19	10	22	33	36	43	46	47	46	25	22	26
Fort Vancouver	25	19	21	33	40	47	50	43	42	28	31	26
Puget sound	25	20	22	34	35	47	44	43	38	29	27	23

HIGHEST TEMPERATURES IN 1853.

Fort Snelling	56	46	58	67	84	86	85	90	90	73	54	47
Fort Benton	......	......	......	......	......	......	......	......	......	80	58	60
St. Mary's	52	51	......	......	......	......	......	......	......	......	......	.....
Cantonment Stevens	52	46	......	......	......	......	......	......	......	......	......	.....
Dalles	50	56	67	78	94	94	105	97	88	84	59	60
Fort Vancouver	51	56	67	74	89	88	91	81	84	62	59	58
Puget sound	55	54	62	67	87	85	94	93	83	78	59	60

EXTREMES OF TEMPERATURE IN 1854—LOWEST OBSERVATIONS.

Fort Snelling	—26	—20	3	9	......	......	......	......	......	......	......	.....
Fort Ridgeley	—24	—17	12	13	......	......	......	......	......	......	......	.....
Fort Laramie	—21	8	21	......	......	......	......	......	......	......	......	.....
Dalles	—16	22	27	......	......	......	......	......	......	......	......	.....
Fort Vancouver	......	20	30	......	......	......	......	......	......	......	......	.....
Fort Owen, St. Mary's	—20	13	......	......	......	......	......	......	......	......	......	.....
Cantonment Stevens	—22	14	......	......	......	......	......	......	......	......	......	.....
Puget sound	— 1	22	......	......	......	......	......	......	......	......	......	.....

No 3.—COMPARISON OF TEMPERATURES AT 42° NORTH LATITUDE AND NORTHWARD.

Place.	Winter of 1852-'53.				Winter of 1853-'54.				Winter of 1851-'52.			
	December.	January.	February.	Winter.	December.	January.	February.	Winter.	December.	January.	February.	Winter.
Puget sound	32.2	39.7	39.8	37.2	44.6	30.6	39.6	38.3	41.1	44.1	43.7	43.0
Fort Vancouver	33.0	37.8	42.1	37.6	41.8	31.0	38.0	36.9	38.2	44.6	44.3	42.4
Dalles	26.1	32.3	37.1	31.8	40.1	22.0	38.9	33.7	......	......	......	......
Fort Benton	......	......	......	......	33.0	......	......	......	......	......	......	......
Cantonment Stevens	......	......	......	......	......	13.9	31.3	26.1	......	......	......	......
Fort Laramie	21.0	34.1	29.7	28.3	33.7	22.6	36.4	30.9	24.7	30.7	33.0	29.5
Fort Snelling	11.8	15.2	6.7	11.2	18.3	1.3	15.4	10.7	10.7	12.7	23.0	15.5
Milwaukie	26.5	28.1	23.0	25.9	26.0	14.7	24.0	21.6	22.0	20.7	28.0	23.6
Buffalo	31.8	26.2	27.5	28.5	29.2	25.4	25.6	26.7	21.3	21.0	26.0	22.8
Boston	36.7	27.1	29.2	31.0	28.0	25.0	25.0	26.0	22.8	21.0	28.0	23.9

No. 4.—COMPARISON OF STATISTICS ON THE ROCKY MOUNTAIN PLATEAU IN DIFFERENT LATITUDES.

Place.	1852.			1853.			1854.		
	January.	February.	December.	January.	February.	December.	January.	February.	March.
Santa Fe	29.6	35.9	30.1	33.1	28.0	31.4	28.7	35.6	41.4
Fort Massachusetts	....	....	19.4	20.4	18.8	....	....	....	....
Fort Defiance	....	....	30.1	29.5	28.0	28.6	24.4	33.7	37.0
Fort Laramie	30.7	33.0	21.0	34.1	29.7	33.7	22.6	36.4	36.9
Fort Hall*	....	....	....	....	....	22.5	24.3	24.1	....
Fort Benton	....	....	....	....	....	33.0	....	....	....
St. Mary's	....	....	....	....	....	....	....	35.4	....
Cantonment Stevens	....	....	....	....	....	33.0	13.9	31.3	....

* December, 1849, and January and February, 1850, are used at this station as the only existing observations.

No. 5.—AMOUNT OF WATER FALLING IN RAIN AND SNOW AT FORTS SNELLING AND LARAMIE.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
Fort Laramie.																	
1849	......	......	......	......	......	......	......	......	0.91	2.72	0.94	0.38	......	......	3.17	......	......
1850	0.30	0.42	1.31	1.03	4.41	1.40	1.89	0.51	0.22	0.92	0.98	......	3.75	3.71	0.79	0.72	8.90
1851	......	......	0.10	0.16	4.91	0.33	0.32	0.78	0.42	0.36	5.20	8.84	4.47	1.43	5.98	8.84	20.72
1852	1.51	1.11	7.76	1.95	7.29	4.06	1.68	1.46	2.74	1.75	6.43	1.23	16.30	7.42	10.92	3.84	38.47
1853	0.08	0.57	1.78	4.53	12.19	4.95	1.80	0.55	2.80	0.08	0.08	0.71	18.50	7.36	3.56	1.38	30.78
1854	0.18	0.40	0.80	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mean	0.52	0.83	2.19	1.74	6.28	2.09	1.47	0.82	1.95	1.15	2.45	2.23	10.21	4.98	4.86	3.28	23.45
Fort Snelling.																	
1850	1.67	0.83	2.23	2.00	0.57	4.02	6.15	2.97	1.80	0.32	1.68	0.04	5.90	13.74	3.80	2.54	25.20
1851	0.20	0.13	1.23	2.68	3.96	2.15	2.08	3.20	3.64	1.18	2.31	0.10	7.87	8.04	7.13	0.43	23.47
1852	0.60	0.14	2.04	2.49	4.72	0.09	2.74	0.69	0.72	0.82	0.22	0.27	9.75	4.43	3.82	2.83	20.85
1853	......	......	......	0.73	4.06	7.80	1.65	2.57	2.14	......	0.56	1.11	......	12.11	2.70	......	......
1854	0.72	0.04	1.03	2.51	......	......	......	......	......	......	......	......	......	......	......	......	......
Mean	0.59	0.28	1.63	2.20	3.33	3.66	3.98	2.43	2.09	0.58	1.19	0.38	7.16	9.30	3.65	1.46	21.66
Mean for 15 years	0.78	0.63	1.37	2.30	3.16	3.40	3.96	2.86	3.11	1.22	1.38	0.58	6.84	10.21	5.72	2.09	21.76

No. 5—Continued.

AMOUNT OF WATER FALLING IN RAIN AND SNOW AT STATIONS IN THE NORTHWEST.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
Puget Sound.																	
1849	......	......	......	......	......	......	......	......	......	......	9.42	8.75	......	......	......	......	......
1850	8.54	4.83	6.70	1.00	0.30	0.40	0.20	......	1.20	2.40	5.14	2.62	8.00	0.60	8.74	15.97	33.31
1851	15.30	1.47	2.90	3.00	1.95	0.55	0.36	0.81	2.68	3.96	3.02	3.93	7.94	1.72	9.66	20.70	39.93
1852	11.50	5.43	5.12	3.34	0.19	0.80	0.93	1.78	1.02	3.72	6.17	8.84	8.58	3.53	10.91	25.77	48.78
1853	8.14	3.24	2.62	1.57	2.08	3.09	3.03	1.10	4.90	6.93	18.41	4.42	6.27	7.30	30.33	15.80	59.70
1854	8.69	7.52	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mean	10.43	4.51	4.16	2.23	1.11	1.29	1.13	1.36	2.45	4.25	8.43	5.71	7.58	3.68	15.13	20.65	46.38
Fort Vancouver.																	
1849	......	......	......	......	......	......	......	......	......	......	......	6.00	......	......	......	......	......
1850	6.66	2.60	6.70	0.40	0.60	3.82	8.35	......	......	......	......	......	7.70	......	......	......	......
1851	9.55	2.04	4.09	......	......	......	......	......	......	......	......	7.93	......	......	......	19.52	......
1852	9.31	4.77	4.26	6.56	3.49	1.77	......	......	......	1.55	7.37	13.37	14.31	1.77	8.92	27.45	51.45
1853	9.30	4.21	2.47	1.72	2.30	0.50	0.70	0.39	2.00	3.06	11.57	3.22	6.49	1.59	16.63	16.73	42.04
1854	......	2.83	1.22	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mean	8.71	3.29	3.75	2.89	2.13	2.16	2.65	0.39	2.00	2.31	9.47	7.63	8.77	5.21	13.08	19.63	46.69
Dalles of Columbia.																	
1850	......	......	......	......	......	......	0.10	......	0.09	0.31	1.14	0.19	......	......	2.14	......	......
1851	3.81	1.70	1.79	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1852	......	......	......	......	......	......	......	......	......	0.85	2.73	8.01	......	......	......	......	......
1853	3.02	1.08	0.27	1.29	0.62	......	0.08	0.61	1.41	0.24	4.90	0.95	2.18	0.68	6.55	5.06	14.48
1854	2.79	0.73	0.36	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mean	3.21	1.17	0.81	1.29	0.62	......	0.09	0.31	0.75	0.47	2.93	3.05	2.79	0.40	4.15	7.43	14.70
Oregon City.																	
1849	......	......	......	......	......	......	......	......	......	......	......	9.09	......	......	......	......	......
1850	11.48	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1851	13.63	3.43	5.86	3.13	4.58	0.40	......	1.90	1.96	4.56	4.09	7.70	13.57	2.30	10.61	24.76	50.68

CHAPTER XV.

Plan of Construction and Details of the Roads.—Estimate of Cost.—Use of Wagon road in connexion with Railroad.

I will now pass to the plan of construction and the estimate of the cost of the road.

The difficult points, those which are obstacles to reaching difficult points, and the portions passing through a rich country, which will at once bring remunerative returns, should be located and attached at once.

The rich, remunerative portions, are the country east from the Bois des Sioux and westward to the crossing of the river Jacques; the valley of the Mouse river; much of the country from Fort Benton to the mouth of Milk river; the region of the Rocky mountains; a portion of the Spokane country; the greater portion of the Columbia valley; the region from the Columbia to the sound, and from the sound back, near to the Cascades, and that from Seattle to the Columbia river.

The difficult points are the passes of the Rocky and Cascade mountains—the former involving a tunnel, the latter a tunnel by the Snoqualme, or a large quantity of rock-cutting of the Columbia; the rock-cutting on Clark's fork, and the heavy embankments and cutting in the Bitter Root valley towards its junction with Clark's fork at Horse Plains, and the heavy sustaining walls of the defile ending in Hell Gate.

Allusion has already been made to a nearer route from the Bois des Sioux to the favorable passes, by crossing the Missouri and the Yellowstone, as well as to a connexion believed to be practicable through the Black Hills with Council Bluffs.

For a route from Council Bluffs to the Columbia valley and Puget sound, the road could be operated on in four sections:

1. Council Bluffs to crossing of Yellowstone.
2. Crossing of Yellowstone to mouth of Snake.
3. Snake river to post on Columbia, and to Puget sound.
4. Columbia valley, by the line of the Cowlitz, to Puget sound.

For a route from the head of navigation of the Mississippi and the Great Lakes, by the Bois des Sioux, the crossing of the Missouri and the Yellowstone, the sections will be:

1. St. Paul and Lake Superior to Little Falls.
2. Little Falls to Bois des Sioux.
3. Bois des Sioux to crossing of Missouri.
4. Crossing of Missouri to crossing of Yellowstone.
5. Crossing of Yellowstone to mouth of Snake river.
6. Snake river to post on Columbia, and to Puget sound by Snoqualme Pass.
7. Columbia valley by the line of the Cowlitz to Puget sound.

The route explored by me north of the Missouri will have sections as follows:

1. St. Paul and Lake Superior to Little Falls.
2. Little Falls to Bois des Sioux.
3. Bois des Sioux to vicinity of Fort Union.
4. Fort Union to mouth of Milk river.
5. Mouth of Milk river to the vicinity of the Great Falls of the Missouri.
6. Vicinity of the Great Falls of the Missouri to mouth of Snake river.

7. Snake river to post on the Columbia, and to Puget sound by the Snoqualme Pass.
8. Columbia valley to Puget sound.

When the rail is laid from the mouth of Snake river to the Pend d'Oreille lake, and the rail pushed from the vicinity of the Great Falls of the Missouri to the tunnel of the Rocky mountains, the intermediate portions can be divided into two sections: 1st. From tunnel to Horse Plains. 2d. From Horse Plains to Pend d'Oreille lake, along the navigable waters of Clark's fork.

It is also possible that the section from the Bois des Sioux to the vicinity of Fort Union can be thrown into two sections by a spur-road a little east of the vicinity of Mouse River valley from the Missouri.

Thus it will be seen that the route north of the Missouri lends itself to a rapid construction, from the facility with which it can be thrown into sections, the largest being from the vicinity of the Great Falls to the mouth of the Snake, which, deducting the navigable waters of Clark's fork, will be ——— miles in length.

The longest section on the route of the Bois des Sioux, and the crossing of the Missouri and Yellowstone and of the Council Bluffs, will be from the crossing of the Yellowstone to the mouth of the Snake, or about ——— miles.

While the final location of the road is being made, all the arrangements can be perfected to operate with great energy simultaneously on the different sections. Suitable steamers should be constructed for the Missouri and Columbia, rails laid at the Cascades and the Dalles to connect the several lines on the Columbia, and spur-roads built where necessary, as at Mouse River valley, at Fort Union, and Fort Benton.

It is probable the Marias may be found navigable a sufficient distance (it is said to be navigable fifty miles) to dispense with the spur-road at Fort Benton; and especially arrangements be made on the upper Mississippi, so that, partly by land and partly by water-carriage, the rails can at once be transported to the Little Falls, and the road go both eastward and westward from the Mississippi.

With these arrangements, all the sections can be operated on simultaneously; two sections along their whole line, with the section along the Columbia river, and most of that portion of the first section included between St. Paul and Little Falls.

In connexion with the construction of the road, and as preliminary thereto, a good wagon road, with substantial bridges across the streams, should be opened throughout the whole length and on the line of the road, except where the route is along navigable waters.

Bends which grow cotton-wood might be planted on the sides of the road where fuel is wanting, and water brought in aqueducts from the Coteau du Missouri towards the river Jacques, and from a reservoir at the Grizzly Bear lake towards Milk river, for the supply of laborers and emigrants. The water, though occurring often, and in sufficient quantities for camping purposes, would have to be transported several miles to portions of the laborers operating on the line, and thus an aqueduct of logs would be the most economical and convenient method of supply.

Six hundred and forty acres of wood planted every twenty miles, will, in fifteen years, yield fuel enough for the use of the engines doing a large business on the road.

In order to open a communication as rapidly as possible, temporary arrangements may be made for the rail in advance of the permanent structure. It is of great consequence to reach points of supply, as wood, stone, materials for blasting, and to make use of the rails for moving them when they are required. Zigzags, and inclined planes, and detours, may be used over the Rocky and Cascade mountains whilst the tunnels are being completed. Every exertion should be made to give such direction to the work as shall enable the road to build the road. The question of timely preparation of depot buildings is well understood, and needs simply to be mentioned.

It is estimated that, allowing two years for reconnaissance, location, and making the necessary arrangements, as constructing spur-roads, establishing the line of steamers, erecting depot buildings and making the contracts, and actually getting the laborers established on the line of the road, a first-class road of the broad gauge, with substantial bridges, could be constructed in five years, with the single exception of the tunnel through the Snoqualme Pass, should the long one be adopted, and that for this tunnel an additional year would be required.

It will be necessary to wait till the road is located throughout its whole extent before commencing operations on the various lines. For the portion east of the Bois des Sioux, with a vigorous and well-directed party, the road can be located in a portion of one season, and the whole line east of the Mississippi, and some one hundred miles west, be actually finished, and the cars in operation, before the difficult interior sections are well entered on. Rails can be laid at nearly the rate of one mile per day, and the grading and bridge structures over the crossing of the Mississippi at the Little Falls are comparatively easy and unimportant.

I am of opinion, that in two years after vigorously commencing operations, a communication can be made between the Columbia valley and Puget sound, and that the rail can be laid from the post on the Columbia to the Pend d'Oreille lake, and a new section, the third year, opened from the Horse Plains; and that the vigorous prosecution of all the sections for three years would enable the cars to be put in motion from the Mississippi to the tunnel of the Rocky mountains, and from the post on the Columbia to some distance beyond Horse Plain.

This consideration gives importance to the Jocko route, which is shorter and has less difficult work than the Bitter Root route. Assuming the Jocko route as a basis, the line could be extended the third year, reliable arrangements having been made to throw laborers ahead and accommodate them on different points, to the crossing of Clark's fork, by the Jocko route.

Thus, allowing two years for locating, in three years a thorough communication could be established, except for the link extending from the Rocky mountain tunnel to the crossing of Clark's fork, a distance of about one hundred and fifty miles.

The wagon road, already adverted to as indispensable along the whole line, should, the third year, be constructed into a first-class stage road, and the fourth year, with the aid of stage-coaches moving one hundred miles a day, (perfectly practicable with good roads, relays of horses every ten miles, and the supplies of forage which the beautiful valleys of the St. Mary's alone can furnish,) a thorough communication can be established by which passengers from New York can reach the valley of the Columbia in nine and San Francisco in twelve days. In two more years the whole line will be opened for the rail. If a practicable route can be got through the Cascades with the short tunnel, the trunk line to Puget sound will be opened at the same time. If with the long tunnel one year more will be required.

It must be observed, as regards these two tunnels, they each can be operated upon in nearly equal sections; and that, as regards time, the principal difference will be the greater length of that shaft of the long tunnel, which must be sunk before the sections are operated on.

In estimating the cost of the road, I have, from the Bois des Sioux to the Rocky mountains, added twenty-five per cent. to the cost at eastern prices, and thence to the Pacific forty per cent. This will be an ample allowance for the increased price of labor and of the transportation of supplies.

The following details of construction are the basis of the estimate: Tunnels to be made for a double track, and have a cross section of ——. The gauge of the road to be six feet. The road-bed to be elevated four feet east of the Rocky mountains and three feet west of the mountains, and the work in all respects to be of the most substantial character. The weight of rail to be seventy pounds to the yard. The bridging and culverts to be of stone or durable timber.

From St. Paul to the Bois des Sioux:

This passes essentially through a prairie and well-wooded country, with no expensive bridging or culvert masonry, or heavy excavations and embankments. This portion, making allowance for the broad gauge and increased care in road-beds, will not cost more than existing roads in Illinois and Wisconsin.

ESTIMATE.

240 miles, at $25,000 per mile	$6,000,000

From the Bois des Sioux to the crossing of Milk river, a prairie region, the Coteau du Missouri having to be surmounted, and some care in the Milk River valley to guard against freshets, and in providing for culverts and bridges:

712 miles, at $40,000 per mile	$28,480,000

From the crossing of Milk river to the Snake, (point where the roads down the Columbia and to the Snoqualme Pass fork,) a distance of five hundred and fourteen miles, about one hundred and fifty miles will involve heavy side-cutting, much of it in rock. The remainder will pass over an essentially prairie region, though at times a rolling prairie. This estimate is for the line of Lewis and Clark's Pass, the Jocko and Clark's Fork rivers. Even in the mountain and wooded region, from the entrance to the Mountain Pass to the crossing of the Spokane, a distance of three hundred and fifty miles, more than two hundred and fifty miles is along prairie or regular river intervale, and less than one hundred miles is on side-hills.

For the difficult work, I estimate 150 miles, at $100,000 per mile	$15,000,000
Remaining work, 364 miles, at $45,000 per mile	16,380,000
Tunnel at Lewis and Clark's Pass, (round numbers,) 13,675 feet, at $120 per lineal foot	1,650,000
Total	33,035,000

From the point of forking of the two roads, to Seattle and Snoqualme Pass, the distance is two hundred and forty miles, which may be subdivided as follows:

Work comparatively light from the Snake to the vicinity of Lake Kitchelus, and from the Snoqualme Falls to Seattle.

193 miles, at $45,000 per mile	$8,685,000
Intermediate work, excepting line of tunnel, 40 miles, at $100,000 per mile	4,000,000
Short tunnel, 4,000 yards, at $375 per yard (round numbers)	1,500,000
Long tunnel, 11,840 yards, about $420 per yard	5,000,000
St. Paul to Bois des Sioux, 240 miles	6,000,000
Bois des Sioux to crossing of Milk river, 712 miles	28,480,000
Crossing of Milk river to crossing of Columbia, 706 miles	41,661,000
Crossing of Columbia to Seattle, on Puget sound, 240 miles	17,685,000

COST OF SPUR-ROADS, RESERVOIRS, AND STEAMERS ON THE COLUMBIA AND MISSOURI RIVERS.

Spur-road to St. Paul	$250,000
Spur-road to Fort Union, and depots	1,000,000
Reservoirs, aqueducts, and growth of wood	2,000,000
Spur-road to Fort Benton	1,000,000
Reservoir and aqueducts, Grizzly Bear lake	1,000,000
Steamers and depots on the Missouri	2,000,000
Steamers and depots on the Columbia	1,000,000
	8,250,000

DEPOTS AND PERMANENT FIXTURES.

Depot at St. Paul	$200,000
Depot at Little Falls and connexion with Lake Superior	150,000
Depot at general plateau of the Bois des Sioux	150,000
Depot in the vicinity of Fort Union	200,000

Depot in the vicinity of Great Falls of Missouri	$200,000
Depot in St. Mary's valley	50,000
Depot near crossing of the Columbia	50,000
Depot at Puget sound, with permanent works for a large travel	1,000,000
Intermediate stations, with equipments for wood and water conduits and connexions with aqueduct	1,000,000
	3,000,000

A detour by Cadotte's Pass would increase the distance some two or three miles, and the tunnel about two miles; the increased cost would be one and a half millions.

The line of the Bitter Root would add to the expense as follows:

Increased length of line, all in difficult country, seven miles, at $100,000 per mile	$700,000

The line from the forking of the two routes to Vancouver would cost as follows:

From the forking of the routes to the Dalles, 133 miles, at $50,000 per mile	$6,650,000
From the Dalles to the plain near Vancouver, 90 miles, at $120,000 per mile	10,800,000
Add for depot buildings at head of navigation of the Columbia, depots looking to a connexion with the Willamette and intermediate depots	250,000
Total cost to Vancouver, 223 miles	17,700,000
From the plain, near Vancouver, to Seattle, on Puget sound, 172 miles, at $40,000 per mile	6,880,000
Add for intermediate depots	150,000
Total cost to Seattle, 395 miles	24,730,000

GENERAL RECAPITULATION.

Cost of road to Seattle by the Snoqualme Pass, using the long tunnel, 1,890 miles	$105,076,000
Cost of road to Seattle by the Columbia valley and the Cowlitz river, 2,045 miles	112,121,000
Cost of road to Vancouver, 1,873 miles	105,091,000
Entire system, St. Paul to the Columbia, with branches down the Columbia and across the Cascades, and a connexion from Seattle direct to the Columbia river, 2,285 miles, at a cost of	129,806,000
To above add for engineering and contingencies	5,000,000

CHAPTER XVI.

Governmental Aid in connexion with the Construction of the Road.—Indians on the Route.

Incidental aids to the construction of the road.—Government aid to be given to all through roads in grants of alternate sections of land, with the usual restrictions. The road should not, however, be a government road, maintained and managed by the general government. It will only entail great expenditure, lead to delay, and call into exercise a power deemed by many to be unconstitutional. The road to be built by private enterprise; the business capacity, great skill developed in capitalists, engineers and contractors, by our railroad experience, availed of, and the whole operation to be pushed with vigor; Irish laborers in the eastern portion, laborers from the Sandwich Islands and China in the western; railroad iron to be brought to the road by the connexion with Lake Superior; every effort made to promote settlement on the road, to furnish supplies, and cause a way-travel to spring up.

The cost of the road will be greatly diminished by grants of land being availed of to encourage colonization, and the methods adopted by the contractors to maintain the working force and procure supplies. The supplies of meat for all the laborers on the line east of the mountains, except for the portion east of the Bois des Sioux, will be furnished from the plains. The inexhaustible herds of buffalo will supply amply the whole force till the road is completed. The Red river hunters, two thousand men, five thousand men, women, and children, and eighteen hundred carts, range from the Mouse River valley to the Red river of the North, and each year in June and July, and again in October and November, carry off to the settlements at Pembina, and in English territory, at least 2,500,000 pounds of buffalo meat, dried, or in the shape of pemican. These people are simple-hearted, honest, and industrious, and would make good citizens. They are well affected towards the American government; would, if the furnishing of the meat were intrusted to them, settle on our soil; and they could with ease, for many years, supply a much larger amount of meat, and at very moderate rates. The Indians of western Minnesota, the Gros Ventres, and the Blackfeet, would also supply considerable quantities. The laborers with their families should be induced to settle on the line of the road; and the company, in the disposition of their grants, should give to them and to settlers small lots contiguous to those reserved by government, which would thus be in demand, and could be sold at an early period at remunerative rates. Soon population would increase, a thoroughfare be opened, and the company's reserved lots could be disposed of to settlers at a considerable advance. I would recommend that the working force, once on the line of the road, be kept there with their families throughout the year, and thus, by a course similar to the above, be induced to settle. This course once carried out, laborers would offer for the work in suitable numbers, and, on the completion of the road, there would be flourishing settlements on the entire line.

But in an incidental way, under the acknowledged sphere of action of the general government, aid can be furnished these roads.

As preliminary to the subject of governmental action, the following observations are submitted in reference to the Indian tribes on the route of the exploration:

The Indians on the line of the route are the Chippewas, Winnebagoes, Sioux, Assiniboins, Crees, Gros Ventres, Bloods, Piegans, Blackfeet, and Crows; and west of the mountains, the

Flatheads, Kootenaies, Pend d'Oreilles, Cœur d'Alenes, Spokanes, Nez Perces, Peluses, Cayuses, Wallah-Wallahs, Dalles, Cascades, Klikitats, Yakimas, Pisquouse, Okinakanes, Colvilles, and some forty tribes west of the Cascade mountains. The only white inhabitants are the traders and employés of the Fur Companies, licensed traders in the unorganized portion of the Territory. East of the Cascades, the employés of the Hudson's Bay Company, and the Red river half-breeds living near the boundary line and near Red river, a portion in American and a portion in English territory.

During the whole course of the exploration the Indians were uniformly friendly, and not a single difficulty in all these extended operations occurred. They were met in council throughout the route, and presents were given to them, with kind words from the Great Father. Our intercourse with the several tribes of the Blackfeet nation was especially of the most cordial character, and for the last ten years have the traders of the Fur Company gone alone into their camps with large quantities of goods in entire safety. These Blackfeet may be considered the Arabs of the North. They having the adventurous spirit of that ancient people, make long journeys in quest of spoils or scalps, and extend their depredations to Snake river, to the emigrant trail, and to New Mexico. Bringing a portion of them into council at Fort Benton, they promised, individually, to cease sending their war parties against other tribes, and to respect all whites travelling through their country, and to use their influence to induce the whole nation to do likewise.

This promise has been respected, and the chiefs present at the council have used their utmost influence to dissuade their young men from going to war. Yet for many years there have not been so many in the tribe, many alleging that this year will be their last opportunity to steal horses, and they must make the most of it. Should a council be held at or near Fort Benton for a general pacification of the Indian tribes on both sides of the Rocky mountains, not included in existing arrangements, I am satisfied that, with the support of the military force, it will, in connexion with subsequent measures, tend to reclaim them and make of them useful members of the State. In the interviews which Mr. Doty, in charge of the meteorological post at Fort Benton, has had with them at their camps in the vicinity of that place, it will be seen they are exceedingly pleased both with the council and the idea of a farm. The improvement which has already taken place in their general character is the guarantee of continued improvement.

I concur in the views of Mr. Doty, given in the Indian portion of this report, to which I will call your particular attention. At this moment it is certain a man can go about throughout their territory without molestation, except in the contingency of being mistaken at night for an Indian.

The report of Lieutenant Mullan will be found full of interest in reference to the honest and brave Indians immediately west of the Rocky mountains, and I cannot but respond to all the warmth and energy of his appeal to the government for their protection. Not doubting that a council will be held, they bear in patience every injury; and the return of three horses belonging to Mr. Doty's train, taken by mistake in reprisals for horses stolen by the Blackfeet, by the Pend d'Oreille chief and five men, I look upon as an act of heroism. They travelled five days through Blackfeet war parties, and delivered them up at Fort Benton, asking no reward, and expressing much sorrow and shame at the act; and this was done by the unanimous vote of the whole tribe in council. Nearly all the Indians east of the Cascades are sincere Christians, mostly Catholics; but the Spokanes and a part of the Nez Perces are Protestants. The interesting report of Mr. Gibbs to Captain McClellan, in charge of the exploration and survey of the Cascades, will, in connexion with the reports of Dr. Suckley, Lieutenant Mullan, and Mr. Doty, give a good general view of the Indians on the route from the Blackfeet nation to the Pacific.

It may be remarked, however, that the exploration has had extraordinary facilities for collecting information in relation to the Indian tribes, and has enabled me to come to conclusions in reference to the general policy that should be pursued towards them. The mountain Indians differ entirely in their character and habits from those of the streams and the shores of the ocean.

The latter subsist on fish and berries, raising some potatoes, but owning few horses or cattle. They are debased in character, and are rapidly reducing in numbers in consequence of their vices and their penury. The mountain Indians, including all east of the Cascades except those of the lower Columbia, own horses and cattle, have small crops of wheat, as well as potatoes, are moral in their habits—polygamy having been abandoned by a majority of the tribes—and for subsistence depend in part upon the chase, resorting to the plains east of the Missouri for the meat of the buffalo. Large numbers of them are expert hunters, particularly the Flatheads, Nez Perces, Cœur d'Alenes, Pend d'Oreilles, and Spokanes. Nearly all the country, indeed, east of the Cascades, is a good grazing country, and most of it is well adapted to agriculture. My own personal observations were quite considerable in this respect, including the country occupied by the Flatheads, Cœur d'Alenes, Spokanes, and the country thence to Colville, and that occupied by the Wallah-Wallahs. Actual settlers invariably speak well of the country occupied by them—the St. Mary's, Colville, Spokane, Wallah-Wallah valleys, and the region near the valleys of the Yakima and its tributaries. The desire of the Nez Perces and Spokanes for a grist-mill in their territories, towards which each family has offered to contribute a horse, is the most significant exemplification of their desire to till the soil. Some of the same Indians east of the Cascades are very poor, especially the Kootenaies; and the project of introducing salmon into the upper Columbia by blasting a race-way, suggested by Dr. Suckley, is worthy of special attention. The Pend d'Oreilles and Cœur d'Alenes subsist much upon deer, the former taking in one hunt, in the winter of 1852-'3, eight hundred, and the latter four hundred and fifty. The straits to which these Indians will be reduced in two years, by the entire disappearance of game, is referred to by Dr. Suckley, and measures ought not to be put off to provide for them. Several of these tribes are rich in horses and cattle, and are famous for their rapid movements. A Blackfoot brave, "the white man's hare," told me, on the Big Muddy river, that he stole the first Flathead horse he came across—it was sure to be a good one. They own still many good horses, though their number and quality have been reduced in consequence of their losses. The Nez Perces are rich, both in horses and in cattle; and the hospitable reception they extended to the members of the exploration passing through their country, taking care of a man lost from Lieutenant Macfeely's party, binding up his wounds, and giving him the means of reaching the nearest settler, Mr. Craig, and receiving into their lodges for some days the members of Mr. Tinkham's party, after their arduous winter examination of the snows of the Bitter Root, show that they are still the good Indians of the time of Lewis and Clark.

The Assiniboins, east of the Blackfoot nation, have been steadily improving in character since the treaty of Laramie, and now sustain an excellent reputation; they previously were considered incorrigible thieves. My express to Fort Union were hospitably entertained by them, provided with a lodge, their horses, saddles, and other heavy articles placed in safe hands; but they were advised to look after their smaller things, as the little children might not be able to keep their hands off them.

I met the Assiniboins in council at a large camp about one hundred and fifteen miles east of Fort Union, and received the strongest assurances of their friendly disposition. They complained of their hunting-ground being restricted by the Red river half-breeds, against whom they asked the protection of the government; and that, in consequence, they found difficulty in getting game for their subsistence through the entire year. The Assiniboins range from the Mouse River valley to the Big Muddy river, or probably to the mouth of Milk river.

The Red river half-breeds range in the country from east of the Red river to the Mouse River valley, and going in large parties, they severely restrict the means of subsistence of the Assiniboins and the Sioux. They are generally accompanied by small numbers of friendly Indians—Chippewas, Crees, and occasionally an Assiniboin. They were met on the large bend of the Shayenne river, that rises south of the Miniwakan lake, between the Mouse river and the ———.

A third party was also on the plains. They are a simple-minded, honest, and industrious population. They are attended by the priests and ministers of religion, and make it a principle to rest on the Sabbath. Their attention to their religious duties on these plains is one of the most striking characteristics of this primitive population. They make two hunts each year, leaving a portion of their numbers at home to take care of their houses and farms: once from the middle of June to the middle of August, when they make pemican, and dry meat, and prepare the skin of the buffalo for lodges and moccasins; and again from the middle of September to the middle of November, when, besides the pemican and dried meat, the skin is dried into robes.

I estimate that four months each year two thousand hunters, three thousand women and children, and eighteen hundred carts are on the plains; and estimating the load of a cart at eight hundred pounds, and allowing three hundred carts for luggage, that twelve hundred tons of meat, skins, and furs, is their product of the chase.

I had very free intercourse with the governors and prominent men of both bands, who expressed a strong attachment to the American government, and a great desire to settle permanently on American soil. I am satisfied they would make good citizens. I have collected a large amount of valuable information in reference to their history, modes of life, and with illustrations by the artist, which will appear in the elaborate report.

The Indians referred to by Mr. Gibbs, in his report, as the Upper Pend d'Oreilles, have been formed at a comparatively recent period under Ambrose as their chief, and are known as the Kalispel or Kalispelms. They consist of a number of wandering families, composed of Spokanes, Kalispelms proper, and Flatheads, who, having intermarried, have formed a habit of sojourning in the general vicinity of the Horse and Camash plains, on Clark's fork, during their annual migrations to and from the buffalo hunting grounds. They have about forty lodges, numbering some two hundred and eighty inhabitants.

The Kalispelms proper, Pend d'Oreilles, have Victor for their chief, and have sixty lodges, or about four hundred and twenty inhabitants. This estimate is lower than that of Mr. Gibbs, but may be relied on. For much valuable information in reference to these Indians, and the Catholic mission established among them, I will refer you to Doctor Suckley's report.

The Cœur d'Alene Indians are under-estimated by all the authorities. They have some seventy lodges, and number about five hundred inhabitants. They are much indebted to the good fathers for making considerable progress in agriculture. They have abandoned polygamy, have been taught the rudiments of Christianity, and are greatly improved in their morals, and in the comforts of life. It is indeed extraordinary what the fathers have done at the Cœur d'Alene mission. It is on the Cœur d'Alene river, about thirty miles from the base of the mountains, and some ——— miles above the Cœur d'Alene lake. They have a splendid church, nearly finished, by the labor of the fathers, laymen, and Indians, a large barn, a horse-mill for flour, a small range of buildings for the accommodation of the priests and laymen, a store-room, a milk or dairy room, a cook-room, and good arrangements for their pigs and cattle. They are putting up a new range of quarters, and the Indians have some twelve comfortable log-cabins. The church was designed by the superior of the mission, Père Avili, a man of skill as an architect, and undoubtedly, judging from his well-thumbed books, of various accomplishments. Père Gazzoli showed me his several designs for the altar, all of them characterized by good taste and harmony of proportion. The church, as a specimen of architecture, would do credit to any one, and has been faithfully sketched by our artist, Mr. Stanley. The massive timbers supporting the altar were from larch trees five feet in diameter, and were raised to their place by the Indians, with the aid simply of a pulley and rope.

They have a large cultivated field of some two hundred acres, and a prairie of from two to three thousand acres. They own a hundred pigs, eight yoke of oxen, twenty cows, and a liberal proportion of horses, mules, and young animals.

The Indians have learned to plough, sow, till the soil generally, milk cows, (with both hands,) and do all the duties incident to a farm. They are, some of them, expert wood-cutters; and I saw at work, getting in the harvest, some thirty or forty Indians. They are thinking of cutting out a good trail to the St. Mary's valley, over the Cœur d'Alene mountains, on the route passed over by me. They need agricultural implements and seeds.

The country, generally, on both sides of the Cœur d'Alene river and lake, is rolling and beautiful. It is interspersed with many small prairies, all affording excellent grazing, and most of them adapted to crops. The rolling country could be easily cleared, and would yield excellent wheat and vegetables. I have no question that all the country from the falls of the Cœur d'Alene to the lower end of the Pend d'Oreille lake, and from the mission for some distance above the lake, a region of three or four thousand square miles, is adapted to grazing and culture. A small portion will be overflowed by the melting of the mountain snows, and another portion will be occupied by mountain spurs or isolated peaks, capable simply of furnishing timber and fuel.

The fathers state that a better site for the mission is furnished by a river flowing from the southeast into the western end of the Cœur d'Alene lake, and called by them the St. Joseph's river. It is said to be larger than the Cœur d'Alene river, to have many prairies along its banks, and that the country generally abounds in wood, grass, and water.

The Peluse number 100 lodges and about 500 people, and are in three bands: One at the mouth of the Peluse river, of forty lodges, under Que-lap-tip, head chief, and Stow-yalt-se, second chief; the second band, of twelve lodges, under So-ie, on the north bank of Snake river, thirty miles below the mouth of the Peluse; and the third band at the mouth of Snake river, of fifty lodges, under Til-ka-icks.

The Flatheads number about sixty lodges, but many of them are only inhabited by old women and their daughters. The tribe has been almost exterminated by the Blackfeet, and the mass of the nation consist of Pend d'Oreilles, Spokanes, Nez Perces, and Iroquois. I estimated their number at 350. Their country is admirably adapted to grazing; they own many cattle, which they corral at night; have at their village sixteen log-houses, and many have small patches of wheat and vegetables. Much greater advances would have been made by them in agriculture, had it not been for their entire insecurity from the incursions of the Blackfeet, and for the great diminution of their able-bodied men. Even Victor, during the last season, cached the remnant of his tribe, and a fine band of horses reserved for the winter hunt, while the bulk of his tribe were on the Missouri plains. At a council held at Fort Owen the Flatheads pointed out to me six or seven orphan boys whose fathers had been, within two or three years, killed by the Blackfeet.

In a general meeting of the tribe, held by Lieutenant Mullan, they expressed a strong desire that an agent should live among them, that they should be furnished with agricultural tools, and that they should be protected against the Blackfeet.

The necessity of an agent is very apparent. The agency should be established near Hell Gate. The St. Mary's valley is not simply the home of the Flatheads; it is the thoroughfare of all the Indians of Washington who hunt the buffalo on the Missouri plains.

Lieutenant Mullan's reports of November 18, 1853, December 14, 1853, and January 25, 1854, are referred to for more full information. The report of Dr. Suckley will also be found to contain much valuable information in regard to these interesting Indians.

The Nez Perces were met on the plains between the Muscle Shell and Yellowstone by Lieutenant Mullan, by myself at the St. Mary's village, by myself on the Cœur d'Alene trail, and by Lieutenant Donelson on that by Clark's fork, in October, on their way to the plains of the Missouri, by Mr. Tinkham on his return from Fort Benton in November, and again by him in their own country on the Kooskooskia river in December. They are on excellent terms with the Flatheads, Cœur d'Alenes, Spokanes, Pend d'Oreilles, and the other Indians of the Territory; travel and hunt together, and are more or less intermarried with them. They undoubtedly live in a rich and inviting country.

There should be an agency established among the Blackfeet near the falls of the Missouri, and, besides, one among the Flatheads in the St. Mary's valley; one on the Spokane plain, for the Indians between the Cascades and Bitter Root mountains; one for the Indians on Puget sound, and an agency or sub-agency (I recommend the former) among the Nez Perces, and also among the Indians on the lower Columbia. Laws should be passed for the extinguishment of the Indian title, and placing the Indians in reservations. It can be done now without difficulty, and should be done before settlements are further advanced. In connexion with each agency there should be one or more farms.

All these subjects will be treated more fully in my final report, and will also be reported on to the proper departments.

Excluding the Indians in the Territory of Minnesota, the Indians on the general line of the route may be estimated as follows:

EAST OF THE ROCKY MOUNTAINS—BLACKFEET NATION.

	Lodges.	Warriors.	Total No.
Gros Ventres	360	900	2,520
Bloods	350	875	2,450
Piegans	350	875	2,450
Blackfeet	250	625	1,750
Assiniboins, Crees, &c.	400	1,000	2,800
	1,710	4,275	11,970

WEST OF THE ROCKY MOUNTAINS.

Flatheads	60	350	
Kootenaies and Flatheads	....	400	
Pend d'Oreilles of Upper Lake	40	280	
Pend d'Oreilles of Lower Lake	60	420	
Cœur d'Alenes	70	500	
Spokanes	....	600	
Nez Perces	....	1,700	
Peluses	....	500	
Cayuses	....	120	
Wallah-Wallahs	....	300	
Dalles band	....	200	
Cascades	....	36	
Klikitats	....	300	
Yakimas	....	600	
Pisquouse and Okinakanes	....	550	
Shwoi-el-pi, or Colville	....	500	
			7,356

WEST OF THE CASCADES.

Indians on the Columbia river	....	....	656
Coast from mouth of Columbia to entrance of Straits de Fuca	....	950	
Straits de Fuca	....	920	
West shore, Puget sound	....	635	
Nisqually	....	209	
Islands and east shore of sound	....	4,189	
			6,903
			26,885

The numbers of the four tribes of the Blackfeet nation are taken from Mr. Doty's enumeration. It is less than that of Mr. Stanley, who visited the Piegans in September last, and whose estimate of the Piegans, Bloods, and Blackfeet, was, 1,330 lodges and 13,300 souls; and it is likewise less than my enumeration, derived from consulting all reliable sources of information in the upper Missouri, and which made the four tribes of the Gros Ventres, Bloods, Piegans, and Blackfeet, amount to 14,400, or 5,230 more than the estimate of Mr. Doty. Mr. Doty has, however, had the opportunity of making an actual count of more than half these Indians, and his estimate cannot be far from the mark. The Assiniboins and Crees are an estimate.

It is with great satisfaction I submit the interesting reports of Mr. Gibbs, Lieutenant Mullan, and Mr. Doty, in regard to Indian matters, for they show the great interest taken in this subject by the officers of the exploration; the thorough manner in which our Indian relations have been investigated; and they conclusively rebut any presumption prejudicial to the route as a practicable route for a railroad, growing out of any supposed hostilities on the part of the Indian tribes. I do not consider that a preliminary report furnishes the appropriate occasion to go into any examination of questions of Indian policy, or details of Indian administration, further than the general views which I have already presented. I have thought it best, however, to submit the reports as they are, in order to bring them at once before the public, in view of their connexion with the great object of the exploration, viz: determining the whole question by route, grades, snows, obstructions from Indians, reserving the full experience of my own views, in matters purely administrative, to my reports to the Indian Bureau. The settlement of Indian matters in the Territory in the region east of the mountains has become urgent.

The attention of settlers has already been called to many pleasant valleys, both east and west of the Rocky mountains, and between the Cascades and the Bitter Root mountains. I am satisfied a portion of the emigration to Washington and Oregon will, after this year, be by the passes explored under my direction. A good connexion undoubtedly exists between these passes and the Platte, which will not only furnish a good route, but a short one.

The route, after the first wagons have passed over, will indeed be better; grass and wood more abundant, and water better; distance less.

CHAPTER XVII.

Establishment of Military Posts.—Extinguishment of Indian Title.—Encouragement to be given to Settlements.—Wagon roads.

1. *Establishment of military posts.*—Two posts should be established—one at the plateau of the Bois des Sioux, the other at Fort Benton. These posts should consist of one strong battalion (half regiment) of mounted men, with a battery of horse artillery and one of mountain howitzers, and be in strength sufficient to send movable columns in case of an Indian disturbance. In connexion with these posts, inducements should be held out to the Red river half-breeds to settle on the Red river of the North, in American territory. They now live near the line, partly in American and partly in English territory.

The central position, geographically, of the Bois des Sioux, and its being a remarkable key to all the railroad routes in Minnesota, has been already shown. As a military position, it is quite central to many Indian tribes, as the Chippewas, Sioux, Winnebagoes, Assiniboins, and Crees. As a necessary precaution, the Red river half-breeds always move in large bands; a corral is made at night with their carts, and guard is kept, and the animals carefully enclosed at night. It is not doubted that the presence of a military post at that place would remove every hostile view on the part of the Indians, and with prudence, and a small distribution of presents, the Indians could be induced to bring the fruits of the chase to the furtherance of the support of the post, and of building the road.

Fort Benton, near the probable head of navigation of the Missouri, is central to the several tribes of the Blackfeet nation, to the Crows and the tribes west of the mountains, and within easy reach of the several practicable crossings of the Rocky mountains. A post could be readily selected having the necessary requisites of good water, grass, and land for tillage.

There would be no special necessity of a post west of the mountains, in consequence of the docility and the honesty of the Indians. Efficient and upright Indian agents will be able to see that their rights are respected, and that they regard the progress of the work without suspicion or alarm. This leads to the consideration of—

2. *The extinguishment of the Indian title*—at least on the line of the road, and for the fertile valleys and regions in connexion with it.

In Minnesota, the Indian title should be extinguished entirely in the vicinity of and east of the Bois des Sioux, from south of the Minnesota to above Little Falls, on the Red river of the North; the whole of the Mouse River valley; the valley of Milk river, till left by the road; the region immediately east of the mountains, from the sources of the Teton to the forks of the Missouri; the whole of the St. Mary's and the Flathead valleys, except a small reservation for the Flathead Indians; and, generally speaking, all the Indians west of the mountains, both in Washington and Oregon, should be placed in reservation, and the country opened to settlement. With prudence, judgment, and the display of a small military force, no difficulty will be experienced in accomplishing these arrangements, so essential to the construction of the road.

3. *Encouragement should be given to settlements*—geographical explorations be followed by land surveys. It is not doubted that, with an energetic land system, not only would a great proportion of the laborers employed in the construction settle on the line of the road, but that the adjacent valleys, and even distant lateral connections, though separated by considerable mountain

spurs, would be filled up. Thus the valleys north of the Flathead lake, that leading to Colville, and many in the Nez Perces and Cœur d'Alene country, would smile with cottages and yield the products of the soil.

The grass and water on the whole route may be considered excellent, especially in the Rocky mountain region.

4. *Wagon roads.*—Independent of the railroad, it is recommended that wagon roads be opened immediately connecting the Mississippi with Puget sound and the Columbia river by the northern passes. In the appendix, H 27 to H 34, are given itineraries of routes from St. Paul to Fort Union; from Fort Union to Fort Benton—first, by the Milk river, and second, by the route between the Milk and Missouri; from Fort Benton to the St. Mary's valley; from the St. Mary's valley to Fort Benton by the Marias Pass; from Fort Benton to the St. Mary's valley by the northern Little Blackfoot trail; from the St. Mary's valley to Wallah-Wallah—first, by Clark's fork, and second, by the Cœur d'Alene route to its intersection with that by Clark's fork, and that by the southern Nez Perces trail; from Wallah-Wallah to the Dalles; from Vancouver to Colville along the eastern slope of the Cascades, including the two passes of the Cascades, the Nahchess and the Snoqualme Pass, and the entire route from Wallah-Wallah to Steilacoom by the Snoqualme Pass, crossing the Columbia above the mouth of the Yakima. These itineraries are quite full, giving a succinct view of the country and difficulties of each day's journey. In some portions obstructions exist from fallen timber, and the time is given which will be required to overcome them by a resolute party of ten men, having their good ox teams, their side-hill ploughs, a few axes and other implements. The river crossings are particularly adverted to.

CHAPTER XVIII.

Papers annexed to the Report.—Maps accompanying the Report.—Field remaining to be Explored.—Concluding Observations.

The following papers are annexed to, and form a portion of, the report:

A.—GENERAL REPORTS.

1. Report on the topography of the route from the Mississippi river to the Columbia, by Mr. John Lambert, topographer of the exploration.
2. Preliminary notice of the geology of the country explored, by Dr. John Evans, geologist.
3. Medical reports of Dr. George Suckley, assistant surgeon U. S. A., and Dr. J. G. Cooper, surgeon of the expedition.

B.—SURVEY OF THE CASCADES.

4. Railroad practicability of the Cascades, and of the line of the Snoqualme Pass, by Captain George B. McClellan, corps of Engineers, United States army, in command of the western division. The survey of the Snoqualme Pass was carried by Captain McClellan up the valley of the Yakima to three miles west of the dividing ridge.
5. Railroad report of the practicability of the Snoqualme Pass, and the obstructions to be apprehended from snow, by Mr. A. W. Tinkham. Mr. Tinkham extended the survey from the point to which it had been carried by Captain McClellan, to Seattle, on Puget sound, and made examinations of the depth of snow in the month of January, 1854.
6. Report of Mr. F. W. Lander, civil engineer, on the railroad practicability of the pass of the Columbia river.

C.—GENERAL REPORTS OF THE SURVEY OF THE CASCADES.

7. General report of Captain George B. McClellan, corps of Engineers, U. S. A., in command of the western division.
8. Topographical report of Lieutenant J. K. Duncan, U. S. A., topographer of the western division.
9. Natural history report of Dr. J. G. Cooper, naturalist of the western division.

D.—SURVEYS FROM THE MISSISSIPPI TO THE BASE OF THE MOUNTAINS.

10. Report of the Dead Colt Hillock line, by Lieutenant C. Grover, U. S. A.
11. Report of Mr. F. W. Lander, assistant engineer, of the crossings of the Mississippi.
12. Report of Mr. A. W. Tinkham, assistant engineer, of his reconnaissance of the "Three Buttes," and of his reconnaissance on the route.
13. Report of Dr. John Evans, of his route south of the Missouri and Yellowstone, and between the Milk and Missouri rivers.

E.—NAVIGABILITY OF THE MISSOURI.

14. Report of Lieutenant A. J. Donelson, corps of Engineers, United States army, of his survey of the Missouri to Fort Union, and of his reconnaissance of the country in the vicinity of Fort Union between the White Earth and Big Muddy rivers.

15. Report of Lieutenant C. Grover, U. S. A., of his survey of the upper Missouri from the Great Falls, to connect with the survey of Lieutenant Donelson.
16. Report of Lieutenant R. Saxton, U. S. A., of his trip in a keel-boat from Fort Benton to Fort Leavenworth, and of the navigability of the Missouri river by steamers.

F.—Surveys from the Eastern Base of the Mountains to the Columbia.

17. Report of the route of Lieut. R. Saxton, U. S. A., from the Columbia valley to Fort Owen, and thence to Fort Benton.
18. Report of Lieut. Donelson as to the railroad practicability of the route from Fort Benton, by Lewis and Clark's and Cadotte's Passes, Blackfoot trail, the Bitter Root and Jocko lines, to Clark's fork, and thence by Clark's fork to Wallah-Wallah, with the sub-reports of Lieut. R. Arnold, U. S. A., Mr. F. W. Lander and Mr. A. W. Tinkham, assistant engineers.
19. Report of Mr. A. W. Tinkham, assistant engineer, as to the railroad practicability of the line of the Marias Pass of the northern Little Blackfoot trail and of the southern Nez Perces trail.
20. Report of Dr. John Evans of his route from Fort Benton to the lower Columbia.
21. Report of Lieut. Richard Arnold, U. S. A., of his route from the mouth of Clark's fork, by Colville, the Grand Coulée, and the mouth of Snake river, to Wallah-Wallah.
22. Report of Lieut. R. Macfeely, U. S. A., of his return from Fort Owen to Wallah-Wallah.

G.—Navigability of the Columbia.

23. Report of Dr. George Suckley, assistant surgeon U. S. A., of his trip in a canoe from Fort Owen down the Bitter Root, Clark's fork and Columbia river, to Vancouver.

Rocky mountain surveys, by Lieut. John Mullan, U. S. A.

24. Report of an exploration from Fort Benton to the Flathead camp, beyond the Muscle Shell river, and thence by the southern Little Blackfoot river to the St. Mary's valley, by Lieut. John Mullan, U. S. A.
25. Report of an exploration from Cantonment Stevens to Fort Hall and back, by Lieut. John Mullan, U. S. A.
26. Report of route from Cantonment Stevens to Fort Benton and back, by Lieut. John Mullan, U. S. A.

H.—Itinerary.

27. Itinerary of the route from St. Paul to Fort Union, prepared by Mr. Tinkham.
28. Itinerary of the route from Fort Union to Fort Benton, prepared by Lieut. Donelson.
29. Itinerary of the route from Fort Benton by Cadotte's Pass, the Jocko river and Clark's fork, to Wallah-Wallah, with an estimate of the time, labor, and cost of making a practicable wagon-road, by Lieut. Donelson.
30. Itinerary of the route from Hell Gate, over the Cœur d'Alene mountains, to the Cœur d'Alene mission, and thence to the intersection of the route just mentioned.
31. Itinerary of the route from Fort Benton, by the northern Blackfoot trail, to Fort Owen.
32. Itinerary of the route from Fort Owen, by the Jocko river, Flathead lake, and Marias Pass, to Fort Benton.
33. Itinerary of the route from Fort Owen, by the southern Nez Perces trail, to Wallah-Wallah.
34. Itinerary of the Cascades, Captain McClellan's route, prepared by Mr. J. F. Minter, assistant engineer.

I.—General Climatology.

35. Report of Lieut. S. Mowry, U. S. A., to Capt. George B. McClellan, corps of Engineers, of the meteorology of the Cascades.

36. Report of the meteorology of the route, by Lieut. C. Grover, U. S. A., from Fort Benton to Wallah-Wallah.
37. Report of Mr. Tinkham of the snows of the Rocky mountains in November, of the Bitter Root in December, and of the Cascades in January, 1853.
38. Letter of the Hon. H. M. Rice, and extracts from letters from Hon. H. H. Sibley and A. Culbertson, Esq., as to the winter climate of the region extending from the Mississippi river to the base of the mountains.

For much additional information in regard to snows, see the several reports of Lieut. Mullan.

J.—Indian Affairs.

39. Report of Mr. George Gibbs to Capt. McClellan on the Indian tribes of the Territory of Washington.
40. Report of Lieutenant John Mullan, U. S. A., on the Indian tribes in the eastern portion of Washington Territory.
41. Reports of Mr. James Doty on the Indian tribes of the Blackfoot nation.
42. Report of Mr. J. M. Stanley's visit to the Piegan camp at the Cypress mountain.

The following maps accompany this report:

1. General map: scale, $\frac{1}{6000000}$; showing the connexion between the route explored and existing roads, and the routes still requiring examination to determine the best route, and its connexions with the routes to the south, with a comparison of the profiles of the route by the northern passes, and of the South Pass, by Mr. John Lambert, topographer.
2. General sketch of the routes explored: scale, $\frac{1}{1200000}$; three sheets, by Mr. John Lambert, topographer of the expedition.
3. Map of the Cascades: scale, $\frac{1}{400000}$; by Lieutenant J. K. Duncan, U. S. A., under the orders of Captain George B. McClellan, corps of Engineers.
4. Map showing the several barometric profiles, with comparisons of such as come into competition.
5. Sketch of the tunnels required on the several lines.

The result, therefore, of the year's exploration, has been to establish the practicability of the northern route; but it is not believed that the best route has been ascertained; and it is known that only the materials have been collected of a very general estimate of the cost of the road. An approximate estimate can be made by throwing the whole distance into parts, having a common character, referring them to similar roads in the States of which the cost is known; and thereby, by making a proper allowance for the changes of circumstances, as the increased price of labor, and the expense incident to operating on a long line, and in a new country, arrive at the cost of the road.

It is important, however, that the field should be extended to embrace all probable routes, that the best route should then be selected, and that detailed instrumental surveys be made, to ascertain the cost and determine the best plan of construction.

The greatest western development of roads is now in Missouri and Iowa, two roads being under construction in the former, and one in the latter State, extending to their western boundaries; and an additional road being projected, and soon to be placed under construction in Iowa, from Rock Island to Council Bluffs, and connecting with the road on which the cars now run from Chicago to Rock Island.

Roads are also extending from Chicago and Milwaukie to points on the Mississippi, from Rock Island to St. Paul, and to the Fond du Lac of Lake Superior and Green Bay.

An examination of the maps will show that, if the Black Hills are practicable for roads, the Hell Gate passes are in most admirable connexion both with the roads of Missouri and Iowa, say at Council Bluffs, and with the roads from the Great Lakes, moving through Minnesota and centering in the grand plateau of the Bois des Sioux.

These examinations, therefore, become of great consequence: first, from the Bois des Sioux across the Missouri, through the Black Hills to the general region between the Yellowstone and Missouri, and thence to the best of the Hell Gate passes, (one is known to be practicable for a railroad;) and second, from the western frontier of Iowa and Missouri, through the Sioux hills, and uniting with the route from the Bois des Sioux and entering the pass together.

The Black Hills are not as formidable as they are represented on the map; on the contrary, quite an extensive region examined by Dr. Evans, the geologist of the expedition, south of the Missouri and Yellowstone, showed that the region was an elevated prairie; and information has been received from reliable sources that the country is almost exclusively prairie in a straight line from the Hell Gate passes to Council Bluffs.

Lieutenant Mullan writes me from the St. Mary's valley that this is the opinion of his interpreter, Gabriel, and that he has received similar information from a trapper who was familiar with the country. Major Ebbels, of San Francisco, a very intelligent gentleman, and who was in the employ of the Fur Company for many years, assures me that the hills are inconsiderable, and would not be an obstacle.

From the results of Dr. Evans' survey, I feel disposed to give much weight to the information thus derived from Lieutenant Mullan and Major Ebbels, and will therefore propose, in the event of the continuance of the survey, that these routes be explored.

Should they prove practicable, the northern route to the head of navigation of the Mississippi, and to the Great Lakes, will be abridged about one hundred miles. The whole road, assuming St. Paul and the Fond du Lac of Lake Superior as the starting points, will be between the 45th and 48th degrees of latitude. The distance from Seattle by the Snoqualme Pass, to Fond du Lac, to St. Paul and to Chicago, will be reduced from 1,905, 1,892, 2,215, to 1,805, 1,792, and 2,115 miles, respectively.

The route to Council Bluffs, to Chicago, and generally to the roads of Iowa and Missouri, will be reduced some 200 miles on that by the South Pass, and making the distances from Seattle to Council Bluffs and to Chicago 1,670, and 2,128 miles by the Hell Gate passes, and 1,992 and 2,450 miles by the South Pass.

So much for the importance of these two examinations coming within the scope of that clause of my instructions authorizing me to despatch the force not required west of the Rocky mountains homeward by new routes. At Fort Benton, if there had been animals to spare, I should have despatched a party to the Platte to examine one of the routes. My attention had been drawn to it before leaving Washington city.

Besides which, there should be an exploration of the Snake river and its western tributaries, and of the Rocky mountains, from the South Pass to the 49th parallel, so far as may not be completed by the labors of Lieutenant Mullan. The relations of the Salt Lake settlement with the region north of the Rocky mountains should be thoroughly established.

The country should be explored from the Columbia lakes to the waters of San Francisco bay, to determine the best connexion between a road having its terminus in the Columbia valley and Puget sound, and roads having their terminus on the waters of San Francisco bay. It is a question whether this connexion can best be made west of the Cascades from the valley of the Willamette to that of the Sacramento, or east of the Cascades. I will propose an exploration to determine the practicability of connecting, by a railroad, the two great valleys of the Willamette and the Sacramento.

The relations of the Great Salt Lake region, both with the waters of San Francisco bay and the Columbia valley, should be ascertained.

I will also recommend, most earnestly, an instrumental survey of the two routes, by the Columbia valley and the Snoqualme Pass, to the sound, of the pass or passes in the Rocky mountains giving the best connexion with the Great Lakes and the head of navigation of the Mississippi, and the roads now running through Iowa and Missouri, of different intermediate parts, and of collecting such other information as will test the relative practicability of routes, give the means of making an estimate of the cost, plan of construction, and the time to build the road.

In closing this report I will respectfully call the attention of the department to the several accompanying reports, which will be found to present accurately the many routes of the field of exploration. They are all creditable to the writers, and many of them are remarkably able. The reports of Captain McClellan will show with what ability and success the extended explorations of the Cascades were conducted, and the great contribution it has afforded to the almost hitherto unknown geography of that region of country.

His remarks in commendation of his party have my most hearty concurrence. The topographical report of Mr. John Lambert shows him to be as successful with the pen as with his instruments.

The lucid reports of Lieutenant Donelson present, in the clearest light, the general characteristics of his railroad line from Fort Benton to Wallah-Wallah.

The extended explorations by Lieutenant Grover, by Lieutenant Mullan, and by Mr. A. W. Tinkham, have given the exploration its greatest value, as they have solved the question of snow for the whole region east of the Cascades, and have made the solution all but certain in the Cascades themselves. The labors of Lieutenant Saxton have been of the greatest service to the exploration. The reports of Dr. Suckley and Lieutenant Arnold, and of Lieutenant Macfeely, will show clearly how each occupied his field.

In the Indian department I will refer, with admiration, to the contribution made by Mr. George Gibbs, of Captain McClellan's party, and to the labors of Lieutenant John Mullan and Mr. Doty.

There will be found a valuable report from Mr. F. W. Lander as to the crossing of the Mississippi, and the practicability of the pass of the lower Columbia. His practical experience as a railroad engineer and contractor has enabled him to make many excellent suggestions, which I beg leave to acknowledge.

I will close this communication by adverting, in terms of the highest commendation, to the ability with which Dr. John Evans has managed the geological portion of the work, and the great contribution he has personally made in collections, and in developing the geography of the country travelled over by him, and to the ability which has been shown by Professor S. F. Baird, in charge of the natural history, assisted by those devoted and promising young naturalists, Dr. George Suckley, assistant surgeon United States army, and Dr. J. G. Cooper.

I am, sir, very respectfully, your obedient servant,

ISAAC I. STEVENS,

Governor of Washington Territory, in Charge of Exploration.

HON. JEFFERSON DAVIS,

Secretary of War.

NOTE.—The additional communications from Governor Stevens, received since this report was submitted, will be found *following* the papers enumerated above.

GENERAL REPORTS.

A.

1. REPORT OF THE TOPOGRAPHY OF THE ROUTE FROM THE MISSISSIPPI RIVER TO THE COLUMBIA, BY JOHN LAMBERT, OF THE EXPLORATION.

WASHINGTON, D. C., *June* 1, 1854.

SIR: In obedience to your instructions, I submit a short topographical review of the regions lying between the Mississippi and Columbia rivers, and generally between the 46th and 49th parallels of north latitude, as developed by the several exploring parties attached to your expedition.

Within the limits stated there appear to be three grand divisions, having boundaries and general characteristics as distinct and peculiar as can be conceived. The vast prairies extending from the Mississippi to the base of the Rocky mountains form the first division, lying approximately between the 94th, 112th, and 113th degrees of west longitude. The second, or mountain division, embraces nearly five degrees of longitude, and is comprised between the great prairies which characterize the valley of the Missouri and the barren plains of the Columbia, and, from the formidable obstacles which it everywhere presents to communication, and in connexion with the objects of the expedition, may be considered of more immediate importance than the others. The third great division comprises the immense plains of Columbia river, already mentioned, which become directly interesting from the uncertainty of their exact character, arising from the various reports of travellers and exploring parties.

Observing this arrangement, I will endeavor to give a general description of each of these great divisions, embracing as much minutiæ as the time at my disposal and the nature of a preliminary and simply topographical report will admit. In the course of my remarks, the main route of the expedition will furnish referring points while considering particular localities, and the distances occasionally stated will be air-lines, rather than the actual measurements obtained on the ground.

That part of the first division lying between the Mississippi and Shayenne rivers has been made so well known already by the labors of eminent travellers, that it seems unnecessary to do more than take a passing glance, concurring with the admirable descriptions already extant, and still fresh in the public mind. Undulating and level prairies, skirted with woods of various growth, and clothed everywhere with a rich verdure, frequent and rapid streams, with innumerable small but limpid lakes, frequented by multitudes of water-fowl, most conspicuous among which appears the stately swan: these, in ever-recurring succession, make up the panorama of this extensive district, which may be said to be everywhere fertile, beautiful, and inviting. The most remarkable features of this region are the intervals of level prairie, especially that near the bend of Red river, where the horizon is as unbroken as that of a calm sea. Nor are other points of resemblance wanting: the long grass, which in such places is unusually rank, bending gracefully to the passing breeze as it sweeps along the plain, gives the idea of waves, (as indeed they are such;) and the solitary horseman on the horizon is so indistinctly seen as to complete the picture by the suggestion of a sail, raising the first feeling of novelty to a character of wonder and delight. The flowing outlines of the rolling prairies are broken only by the small lakes and patches of timber which relieve them of monotony and enhance their beauty; and though marshes and sloughs occur, they are of too small extent and too infrequent to affect the generally attractive character of the country. The elevation of the rolling prairies is generally so uniform, that even the summits between streams flowing in opposite directions exhibit no peculiar features to distinguish them from the ordinary character of the valley slopes.

The country near the Shayenne as it flows southward assumes a bolder character: the swelling surface takes the forms of terraces and ridges; ponds and marshes occur more frequently; timber disappears from the uplands; the prairie becomes gravelly and abounds in granite boulders; and the river itself, moderately fringed with wood of different kinds, flows through a deep intervale enclosed by sand and clay bluffs from one hundred and fifty to two hundred feet and more of elevation, which are again surmounted by occasional hills sufficiently conspicuous to serve as landmarks to the hunters, and associated with thrilling reminiscences of Indian story.

Leaving the Shayenne, the prairie for a considerable space shows no material change; a salty efflorescence appears in spots, betokening our vicinity to Miniwakan lake, the meridian of which may be generally considered as the limit of previously authorized explorations north of the Missouri, and also of the region of the more fertile prairies, the pretty wooded Lake Jessie being the last well-known object on the route pursued by the expedition. From this point westward, and a little north of west for more than forty miles, to where the route strikes the Jacques or James river near its source, the country presents the same alternation of rolling prairie, flat intervals, marshy pools and small lakes, some of which have timber, with bluffy banks; the greater number bare, with a level shore-line. The Jacques river flows from this point southeast almost parallel to the course of the Shayenne, embracing with that river the summit which, in this region, divides the waters flowing to the Red river and the Missouri. This summit ridge, rising abruptly from the Shayenne, attains its greatest altitude in successive terraces; the slope is more uniform towards the Jacques, which flows between low banks, and for a long distance without timber. The ridge terminates towards Dead Colt Hillock, where it merges in the level sweep of prairie extending from the Bois des Sioux; farther south, on the headwaters of Wild Rice river, rises the head of the Coteau des Prairies, leaving an interval which at once strikes the eye of an engineer as the natural roadway through this great labyrinth of rivers, the only obstruction being the easy crossing of the Jacques.

The main route, about thirty-five miles from the point last mentioned, and in the same general course, crosses the Shayenne for the third time; here this river flows in a northeast course, making a long circuit before it bends to the south, and receiving a considerable tributary from the northwest, as reported by the guide. It presents at this point the same character of intervale and steep bluffs, but less water, and no timber. Five miles farther rises the Butte de Morale, one of the ordinary prairie hills, so named to commemorate some incident of the hunting ground or the war path. From the top of this hill the aspect of the country grows wilder and more hilly, in other respects maintaining the same general character. It will serve somewhat further to indicate the topography of this section to state that, from Lake Jessie to Mouse river, a distance of about one hundred and twenty-five miles, timber was only once met with in the ravines of some hills surrounding a small lake about midway between the Shayenne and Mouse rivers; an abundant substitute for firewood, however, is found in the dried buffalo *chips*—still more elegantly called the "bois de vache"—which makes it unnecessary for travellers and hunters to leave their direct course for the small wooded lakes. From this point also is seen the coteau of the Missouri looming prominently on the horizon, and marking the limit of the more open prairie. Keeping a northwest direction, the coteau culminates, so to speak, in the Dog House hill, the most conspicuous object on the plateau; still, in the same course, it bounds the narrow valley of Mouse river, which presents a similar but not so bold a formation on the other side, the width of the valley as far as seen being less than twenty miles. The direction and appearance of the coteau at once destroy the supposition of any waters of Mouse river rising within a mile of the Missouri, as previously reported, and so represented on the most authentic maps. Wintering river is the only branch of Mouse river crossed by the route of the expedition, and is more of a slough than a river—the stream being hardly perceptible through the pools created by the track of the buffalo. No fact of this kind was reported by the guides, and Wintering river was actually headed by one of the small detached parties, though without having this circumstance especially in view; and it is impossible to suppose that such an insignificant water-course should have a length and volume necessary to penetrate the formidable plateau of the Missouri.

This misconception is stated at length to show the uncertain character of information supplied by guides, who, however well acquainted with the country in which they hunt and live, are rarely capable of expressing themselves with reference to any subject foreign to their own pursuits, besides being always liable to be misunderstood from the confusion of tongues which is usually heard on the outskirts of civilization. It is but justice here to say that a signal exception to these remarks was ever presented in the intelligent and exact description of our French guide, Mr. La Bombard, who accompanied the main train to Fort Benton.

Mouse river presents a new river character in the deep and ramified coulées which intersect the valley in every direction, in other respects closely resembling the Shayenne, having a narrow but dense fringe of oak, ash, maple, and other timber, filling the intervale, and extending some way up the intricate coulées; in some of which are found small streams in sandy beds, and massive sandstone rocks. Many of them reach to the edge of the Missouri plateau, which is here well defined; and in the examination for a good passage for the wagon train, secluded spots were found where beetling crag and winding stream, venerable trees and greenest sward, combined in scenes of much picturesque beauty.

The main route strikes Mouse river at its most southerly bend, about one hundred and twenty-five miles from Lake Jessie, from which point the river turns abruptly northward towards its confluence with the Assiniboin. In the same general course of northwest the route runs nearly parallel to the course of Mouse river, heading the coulées for thirty miles, when the river is found coming down from the north, being joined at this turning point by the Rivière des Lacs, which flows southeast from the most northern edge of the great plateau, of which it may be assumed as a boundary. From Dog House hill to the junction of the Rivière des Lacs the coteau decreases in elevation, until blended insensibly with the rolling prairies rising from that river. On the approach to these high prairies from the more open country the swelling outline assumes the appearance of a distant coast, which seems to rise in a direction parallel to the route of the traveller, and suggests the idea of a plateau or bench of table-land beyond; hence the use of the word "coteau." But this appearance has proved so frequently deceptive with reference to the extent of tracts exhibiting it, that only a thorough exploration can be relied upon: thus the preliminary sketches in the neighborhood of Fort Union represented this phantom coteau running in whatever direction the line of examination was conducted; so that it will be only when all the detached surveys are combined that the exact extent of these plateaux can be determined.

The plateau between Missouri and Mouse rivers cannot be called simply a rolling prairie, though in detail resembling the hilly prairies noticed, but in a very exaggerated degree: a general similarity of outlines; the absence of wood and rocks in place; boulders plentiful; ponds and marshes if possible more frequent; but the elevations so much greater as to be almost considered mountainous, and becoming still more rugged on the approach to Fort Union, where it ends abruptly on the level intervale of the Missouri. It is intersected by numerous water-courses, which run dry in summer, showing the same character of sandy and clayey soil in the bottoms, which is also seen in the rain-worn sections of the most elevated points. The principal of these is the White Earth river, its character being partly indicated by its name, heading in several marshy lakes within the limits of the plateau, and flowing in a winding southerly course to the Missouri about fifty miles east of Fort Union. Vegetation is generally scanty on this plateau; grass is rank in the bottoms, but mostly thin and inferior for grazing; the prickly pear, the most common kind of cactus, begins to appear; and the wild turnip is found in comparative abundance, being the only useful production, and probably the only vegetable food of the wandering Indians, by whom it is regularly gathered.

North of the plateau an admirable reconnaissance by Mr. Lander develops a low, marshy prairie, extending with little variation of surface to the head of Mouse river, beyond the forty-ninth parallel; returning from which river to Fort Union, the plateau is found declining to a wide valley or coulée, connecting almost directly with the Missouri in a southwest direction, offering a good chance to *turn* the coteau in an engineering view, and becoming thus another important *key point* on the railroad route.

From the Shayenne to Fort Union a great many particulars are necessarily passed over, as a detailed notice of them would stretch to tediousness: the number of small ponds and marshes (the nurseries of myriads of frogs which positively rise in shoals when intruded upon) are almost beyond counting, and could not possibly be represented on a general map; salt marshes and salt-water lakes occur irregularly; around some of the small lakes the air is impregnate with the offensive exhalations from their waters; and, in one instance, a narrow neck but a few yards wide separates a lake of purest fresh water from another which is intensely salt. Further notice of such facts belongs more properly to the province of the mineralogist, and need not be extended in a topographical sketch.

The Missouri from the Yellowstone to Milk river is a wide and turgid stream, with an ever-shifting channel choked with sand-bars, which are influenced by every storm; its great volume of water, however, insuring a navigable channel on one side or other. It flows with a very sinuous course through an intervale of variable width, enclosed by the tall bluffs of the plateaux on either side, which sometimes project upon the bank, in some places leaving an intervale of five or six miles; it is generally deeply fringed with the cotton-wood and its congeners, and occasionally a dense underbrush, affording a secure haunt to the fierce grizzly bear; good grazing occurs in spots, but is generally better among the bluffs and coulées than on the plain, where the soil is mostly hard and dusty, affording, it might be supposed, but a scanty sustenance even to the swarms of grasshoppers, which in certain conditions of the atmosphere take wing, and are seen drifting in a darkening cloud for hours before the wind. The bluffs are composed mainly of a soft, half-formed sandstone, which crumbles under a slight pressure, and is washed by the rains into the most fantastic shapes, resembling fortifications and ordinary buildings; one of these near the confluence of Big Muddy river is well known as the "Cottage Rock." The sandstone, or rather sand-rock, as it washes away, discovers petrifactions and lignites of a large size, and is sometimes heard falling in large masses with a dull, muffled sound. These are the "Mauvaises Terres," or Bad Lands of the hunters, which occur at irregular intervals all along the Missouri, and many of its tributaries, and in some places are of great extent. The columnar and grotesque forms which are seen in great numbers in such places, are probably owing to the unequal induration or cohesion of what was the upper stratum of a vast alluvial deposit; the softer parts yielding quickly to the "scooping action of denudation," while the harder portion of the sand-rock became so many fixed points—*foundations*, as it were—for the formation of a column, the structure commencing at the top. A better idea of their appearance cannot be furnished than by giving an extract from a most effective description by Dr. Evans, in Owen's Geological Survey: *

> "To the surrounding country, however, the Mauvaises Terres present the most striking contrast. From the uniform, monotonous open prairie, the traveller suddenly descends one or two hundred feet, into a valley that looks as if it sunk away from the surrounding world, leaving standing all over it thousands of abrupt, irregular, prismatic and columnar masses, frequently capped with irregular pyramids, and stretching up to a height of from one to two hundred feet or more. So thickly are these natural towers studded over the surface of this extraordinary region, that the traveller threads his way through deep, confined labyrinthine passages, not unlike the narrow, irregular streets and lanes of some quaint old town of the European continent. Viewed in the distance, indeed, these rocky piles, in their endless succession, assume the appearance of massive artificial structures, decked out with all the accessories of buttress and turret, arched doorway, and clustered shaft, pinnacle, and finial and tapering spire. One might almost imagine oneself

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* Report of a Geological Survey of Wisconsin, Iowa, and Minnesota, by D. D. Owen, page 197.

approaching some magnificent city of the dead, where the labor and genius of forgotten nations had left behind them a multitude of monuments of art and skill.

"On descending from the heights, however, and inspecting in detail its deep intricate recesses, the realities of the scene soon dissipate the illusions of the distance. The castellated forms which fancy had conjured up have vanished, and around one on every side is bleak and barren desolation. Then, too, if the exploration is made in midsummer, the scorching rays of the sun, pouring down in the hundred defiles that conduct the wayfarer through this pathless waste, are reflected back from the white or ash-colored walls that rise around, unmitigated by a breath of air or the shelter of a solitary shrub.

"The drooping spirits of the scorched geologist are not, however, permitted to flag. The fossil treasures of the way well repay its dullness and fatigue."

The scientific explorer finds inexhaustible sources of interesting speculation, even in the midst of these desolate wastes. But the curiosity of the mere tourist is soon sated in such arid and gloomy wilds; he hastens to find again some grassy oasis and umbrageous shade, and remembers the Mauvaises Terres as a very skeleton of nature, or the wreck of an embryonic world.

The character of the Missouri, and its facilities for navigation, will be fully developed, from the States to the Falls, by the surveys of Lieutenants Donelson and Grover.

The streams flowing into the Missouri between Fort Union and Milk river are Little Muddy river, a small stream with clay banks and clay and pebbly bottom, with underbrush in a few places; it has a few branches heading in marshes, and mostly dry in summer. Next, Big Muddy, or Martha's river, a large sluggish stream in a soft clay bed, which keeps the water always discolored and thick; it flows in a deeper valley than the others, and is everywhere difficult to cross; it has no timber or underbrush except near the Missouri, and flows from side to side of its narrow valley, making a series of regular and similar figures. Next, Poplar river, a rapid stream over a sandy and pebbly bottom; it is pretty well fringed with poplar and cotton-wood, and has a similar regularly sinuous course. Next, Porcupine river, in a sandy bed, and not much water—scattered trees and underbrush near the Missouri. There are other smaller water-courses, dry in summer.

All these streams head in the small lakes and marshes of the plateau, flowing nearly in right angles to the Missouri. They have no great length of course, or anything calling for particular notice, except that the deep valleys which they have scooped through the plateau oppose serious obstructions to a direct line of travel, and make it necessary, or at least advisable, to keep along the Missouri bottom.

Milk river joins the Missouri one hundred and five miles due west of Fort Union. Its direction up stream is northwest for fifty-five miles, where it is joined by a considerable branch from the north, which, like the main river, is fringed with cotton-wood; thence generally due west, for one hundred and twenty-five miles; and again northwest, from one hundred to one hundred and fifty miles, to its sources in the great prairies. It will be remembered that the distances stated would probably be trebled by the sinuosities of the river, and are even less than the straightest lines that could be drawn through the interval; the object being to present only a general view of the most important features. Milk river—so named from the extraordinary whiteness of its water, which is thick with chalky solution and fine sand—may be considered a miniature of the Missouri, resembling it in most particulars, and differing only in magnitude and one other point, namely, that through more than its upper half the river-bed is apparently dry, the water percolating through the quicksands, which are of considerable depth, and occasionally forming deep pools where water can always be procured. The running stream is seen again in the little branches from the Three Buttes, and probably in other sources. A branch is supposed to head in a considerable salt lake, called Pakokee, between the Three Buttes and Cypress mountain; but this is not satisfactorily established. At the last turning point mentioned, it is joined by a small fork, coming from the southwest about thirty miles, and heading in coulées within thirty miles (in the same course) of the junction of the Marias and Missouri rivers. In the space embraced by the Missouri and Milk rivers are two distinct groups of mountains, the first that are seen on the route—the Bear's Paw group filling the western end of the enclosed section; the Little Rocky mountains occupying the centre, besides groups of prairie hills. These mountains abound in varieties of pine timber, and practical roadways are reported; but Milk river, from its unexpected directness from its mouth to the turning-point north of Bear's Paw mountains, and from its firm and level though narrow intervale, is emphatically the natural highway westward through this section of the prairies. The mountains it embraces, with the Missouri, will be fully developed by the explorations of Dr. Evans and Lieut. Grover, reports of which have not yet been received.

From the route on the fork of the Milk river, along the western base of the Bear's Paw mountains, an isolated mountain group (the Three Buttes, already mentioned) is seen distinctly for several days, to the northwest, at a distance of seventy miles, as ascertained by the intersection of frequent compass observations from the line of the odometer survey. The position of every prominent hill was accurately fixed in this manner, and served to give greater precision to the several lines of exploration which passed them with estimated distances. On approaching the mountains, it is surprising how clearly the most distant objects can be distinguished. The atmosphere becomes so transparent, that it is only the curvature of the earth's surface that limits the view from the highest points; the crevices and minute features of distant hills appear so well defined, that all previous ideas of distance are disturbed; and amusing mistakes are made by parties intent on exploring some interesting feature, apparently only a few miles off, but which, when tried, turns out to be a fair day's journey.

The Three Buttes are well wooded with pine, and watered by small streams flowing to the different rivers of the prairies. Their greatest altitude above the plain is about three thousand three hundred feet; and from the summit the view is highly illustrative of the surrounding country, embracing every prominent object within a hundred miles. On the north, about ninety miles, stands Cypress mountain, far over the 49th parallel; on the east and northeast, the interminable prairies; on the southeast, the Bear's Paw mountains; on the south, the various detached groups of mountains beyond the Missouri; and on the west, about ninety miles, is seen the dividing ridge of the Rocky mountains, which is itself the boundary of the prairies in this direction, having none of the broken spurs which present an easier access farther south. The intervening regions present but few objects to arrest the eye; they are intersected by the various rivers and their branches, which are hidden, even with their timber, in the deep intervales common to them all. It may suffice to say that there are probably few other places in the world where twenty thousand square miles can be embraced in the view from a single point.

Marias river is the first of the prairie streams having its sources at the base of the mountains. Its general course is southeast by east, and its length about one hundred and thirty miles. It resembles the Missouri in its character of intervale and tall steep bluffs, which, with its fringe of cotton-wood, disappears altogether near its sources. Within a mile of its mouth it receives the Teton or Tansey river, a smaller stream of similar character, rising also at the base of the mountains. These rivers appear to have worn quite down through the soft formations of the prairies, and flow in clear and rapid streams on the underlying indurated strata. Marias river is reported by competent judges to be capable of improvement, so as to be navigable by light steamers for fifty miles of its length.

From the crossing of Marias river near its mouth to Fort Benton, it is about eleven or twelve miles, southwest. About half that way the Teton and Missouri flow so near each other that the traveller perceives their waters from the dividing bluff, apparently not more than one hundred yards apart, but really much more, of course. About fifty miles more, in the same course from Fort Benton, reaches Sun river, eight or nine miles from its mouth. This distance is through the high prairie between the Missouri and Teton, presenting the usual plateau character of bluffs and coulées, and containing the most considerable field of prickly pear that was seen; some dog villages, and one or two small lakes. Medicine or Sun river forms a boundary between the mountains and the prairies, and exhibits a mixed character of bluffy intervale, open valley, and mountain rapid; having an easterly course about eighty miles in length, and joining the Missouri above the Great Falls. It rises in a few small branches, where the dividing ridge of the Rocky mountains begins to break down into spurs and valleys towards the Missouri; and when the traveller has crossed this river, he perceives that he is quitting the great prairies and entering the mountain region.

Of the twelve hundred miles travelled distance from St. Paul of prairie country between the upper Mississippi and the Rocky mountains examined by the several parties of the expedition, the finest section is that from the Mississippi to the Shayenne, embracing some of the rivers on the western slope of the Mississippi basin, as the Sauk, the Watab, Little Falls creek, &c., and the summits between these waters and the various affluents of the Red river, the Minnesota or St. Peter's river, and the Missouri. The greater part of this section, as noticed in the commencement of this report, is considered by parties of approved experience to resemble the most favored districts of Ohio and Wisconsin; and there can be no question of its great capacity and resources, even while confining the examination to its surface only.

Towards the Missouri plateau, and northwards over Mouse river to the Assiniboin, the country is comparatively of inferior character, though abounding, probably, in greater quantity and variety of game; which, with its red hunters, is ever found retiring before the pioneers of the white man's progress. From Fort Union westward the aspect of the country is almost uniformly wild and barren; and this, not because the country becomes so much more inferior, as for reasons referable to uniformity of elevation and dryness of the climate, which apply more or less to all the great plains north and south between the Mississippi and the Rocky mountains. The great mountain ranges near either coast of the continent exclude the fertilizing ocean vapors from the far interior; and even the slight degree of moisture which the waters of the high prairies afford to the atmosphere is floated off to the mountains before it is precipitated in rain; hence, probably, the total absence of timber, except in the river bottoms, and the thinness of the grass, which, as well as the earth itself, in early summer becomes parched and browned under cloudless skies and scorching suns.

Along with such general reasons must be mentioned the more particular one, of the frequent prairie fires which mark the tracks of Indian tribes and half-breed hunters. The prairie is often fired as a signal to distant parties, and not unfrequently for very trifling purposes; and, if left unquenched, will sweep over the country until stopped by a river, and leave an appearance of utter desolation. The eye grows weary travelling over the naked outlines of the successive plateaux, which, divided and bounded by the various rivers noticed, form but subdivisions of the great tract of country stretching from Missouri and Milk rivers on the south, to the Saskachawan on the north—this tract itself but a subdivision of the Great Plains—an extent embracing every variety of surface, from large and level plains to abrupt bluffs and ranges of summit hills that might be considered mountains. It is difficult to convey an adequate idea of the immensity of these dreary solitudes. Let it be remembered that a few minutes' reading embraces sections which require tedious weeks to traverse; and that even travelling over and observing them with the patient labor of months, leaves but a *feeling* of their vastness, which baffles the effort to express it. The impressive silence of succeeding days is broken at rare intervals by the crack of some stray hunter's rifle, or perchance by the yell of painted warriors on a foray; but when the twilight wanes over the peaceful camp, when the evening meal is over, and the incidents of the march are recounted, then the "drowsy ear of night" is roused to listen to the prolonged and melancholy cry of prowling wolves.

The verdure of these regions, though growing thinner and comparatively inferior as we go westward, never entirely disappears anywhere, if the faces of the steep bluffs upon the rivers be excepted; artemisia and small cacti are occasionally met with, but not in great quantities, and even where they do appear, not exclusively monopolizing the soil; and though the wild aspect and dull colors of the landscape in many and extensive sections might induce a supposition of barrenness, the idea must be greatly qualified, if not removed, by the fact that all these regions are the pasture-grounds of frequent herds of various kinds of deer, particularly of the graceful antelope, with quantities of inferior game and species of vermin, and, last and greatest, the unfailing millions of the uncouth and ponderous buffalo.

On the approach to Fort Benton from the Bear's Paw mountains, the Highwood, Girdle, and other mountain groups south of the Missouri, appear and are passed in succession, exciting the traveller's attention as they stand with reference to the great Rocky range, like the preface of a new and interesting book; they all abound in pine, cedar, &c., and are watered by numerous small streams, which fertilize the extensive prairie valleys between the mountains, affording good pasture for the game of the country, and large bands of Indian horses. The highest peaks have an immediate altitude of about 1,800 feet, apparently, and the sight of their blue summits makes a welcome relief to the monotony of the prairies. Soon the cloudy heights of the Rocky mountains come dimly into view, towering in mid air, and rousing all hearts and nerving every arm for the things that, in anticipation, are to be attempted and endured; a few days of recruiting, consultation and arrangement at Fort Benton, and the convenient wagons are reluctantly relinquished; every kind of weight that can be dispensed with is set aside; packs are carefully balanced; exploring parties are arranged for the various routes; long farewells are exchanged, and once more the several parties press forward to their most serious task.

The character of the mountain approaches is as various as the number of passes that have been explored. From the sources of Medicine river to the 49th parallel, a distance of over 100 miles, the dividing ridge rises so abruptly from the great plains as to present everywhere the appearance of being totally inaccessible, though it is not unlikely that a small determined party might scramble through, or over it, at any given point. As seen from the Blackfoot trail, the eastern front of the ridge rises with a slope too steep to allow the accumulation of soil, and their naked, frowning peaks seem to be conscious of their forbidding greatness, and to threaten destruction to the adventurous traveller. In this extent but one practicable horse-trail is known—that called Marias Pass, at the head of the same named river—and is of such a difficult and even dangerous character, that it is but rarely used; the Indians preferring to cross the mountains by a long detour to the south. The relations between the tribes on either side may possibly also affect the choice of way. The next is an easy pass on the head of Medicine river, believed to have been used by Lewis and Clark; it is of easy access from the prairies, and maintains the preference first given to it for the railroad route. The next, again, is on the south fork of Dearborn river, known as Cadotte's Pass, on the Blackfoot trail, and is, probably, the most difficult of the *practicable* road-ways, both on the approach and in the pass itself; it was used by the main train of the expedition, and will be the subject of further notice in this report. Not many miles farther south are two good passes between the forks of Hell Gate river and small streams flowing to the Missouri; they are reported as highly favorable for wagon roads, and are, one or both, no doubt, the "grand defile" of the older maps. A sixth pass, called the "Big Hole Mountain," on Wisdom fork of Missouri, and at the head of the St. Mary's valley, was examined and reported upon favorably in time for the preliminary report. At a slight expense it can be made practicable for wagons, and will give a good connexion between the northern and central emigrant routes. Other passes were explored by the winter parties; so that a thorough account of the mountain passes may be looked for from Fort Hall to the 49th parallel. Although the mountains will, of course, be made more fully known when the surveys are brought to a close, enough, however, is known from the surveys received to give a good general idea of the configuration of the mountain country between the 46th and 49th parallels.

The dividing ridge from the 49th parallel, approximate longitude about 113° 30′, runs in a general course of south-southeast about 180 miles, to the passes mentioned at the head of Hell

Gate river, where the first small branch or spur-ranges extend in a broken, irregular manner, towards the bend of the Missouri, where this river comes down from the south and turns eastward, about forty miles above the Great Falls; thence, the ridge sweeps round to the southwest to the Big Hole Mountain pass, some thirty miles south of the 46th parallel, in longitude about 114°, an air-line distance of near 130 miles. From near this point a great branch-range occurs, running northwest about 150 miles or more to the Cœur d'Alene country, and dividing the waters of the Bitter Root river from those of the Snake, or Lewis's fork. This arrangement of the great summit ranges is something like the letter U, or the form of the ancient lyre, with the open end to the northwest, in which direction the main channel of Clark's fork tends, until it meets the Columbia coming from the north, almost exactly on the 49th parallel. Including the spurs depending from the arms of the figure indicated, there is a general breadth of over 200 miles of mountain country, or about four and a half degrees of longitude. Towards the centre of this great feature, the streams flow from all sides like the radii of a circle—the Flathead river, and smaller streams, from the north; the Blackfoot fork and Hell Gate river from the east; the Bitter Root from the south, and the Lou-Lou fork and a small river, leading to a pass in the Cœur d'Alene mountains, from the west; the latter flowing in a parallel but opposite direction to the main channel, which receives them all. With the exception of certain valleys and prairies to be mentioned, the whole mountain country is thickly covered with pine forest; cotton-wood and some other kinds appearing occasionally on the islands and banks of the rivers, which generally flow in deep and narrow valleys. The mountains are embellished by lakes of various extent; some too small to show on a general map; others, as the Flathead and Pend d'Oreille lakes, of considerable size, are studded with small islands, and, hemmed in as they are by tall mountains on every side, they present scenery of much wild beauty and magnificence. These two lakes have been sketched with tolerable accuracy. Other lakes have been reported, but have not hitherto been visited by the parties of the exploration. All the waters of the mountains abound in fish, particularly salmon and salmon-trout, and are frequented by varieties of water-fowl, as swans, geese, ducks, &c. The mountains also embrace numerous level, or comparatively level, and open prairies of various extent, which afford fine pasture for the Indian cattle, and are most welcome halting and recruiting places for the flagging energies of men and horses, when exhausted by mountain travel. But the fine valleys, enclosed by the great ranges, are the most important of the topographical features; the principal is that of the St. Mary's or Bitter Root river, tending north by east from the sources of the river, near the Big Hole mountain, between seventy and eighty miles to near the confluence of this river with the Hell Gate and Blackfoot forks. It has a level, open bottom, from four to seven or eight miles wide, through which the river flows in a gently winding course, fringed with cotton-wood and pine. On the west side the mountains rise sharply from the general level to a height of certainly not less than two thousand five hundred feet along the whole length of the valley, heavily timbered and crowned with rugged peaks of naked rock; on the east side, however, the slopes are gradual and very free from timber, having grass growing almost to the summits. The area of this valley has been variously estimated. Captain Clark* says: "The valley is from ten to fifteen miles in width, tolerably level, and partially covered with the long-leafed and the pitch pine, with some cotton-wood, birch, and sweet willow on the borders of the streams. Among the herbage are two species of clover: one the white clover, common to the western parts of the United States; the other much smaller, both in its leaf and blossom, than either the red or white clover, and particularly relished by the horses." "The valley became more beautiful as we proceeded, and was diversified by a number of small open plains abounding with grass and a variety of sweet-scented plants, and watered by numerous streams, which rush from the western mountains with considerable velocity." This valley is the favorite winter resort of some of the Selish or Flathead tribes, on account of the pasture which it always affords their bands of cattle. Most of the soil is said to be capable of cultivation, and altogether it seems but to require the advent of the white man to make it a place of considerable importance. The country also around the Flathead lake is reported to be well adapted for settlements, having extensive open prairies and numerous streams. From the confluence of the Bitter Root and Hell Gate rivers to that of the Bitter Root and Flathead rivers, the valley is of a rugged and difficult character. The mountains close upon the river, forming an intricate and formidable cañon for some ten or twelve miles above the junction, the course of the river being extremely sinuous. The formation of the country, however, affords the chances of more than one favorable detour. With reference to this section of the main river, a glance at the map will save the necessity of detailed description here, and which, no doubt, will be found in the reports of the engineers. Thence the valley of Clark's fork is densely timbered along to Pend d'Oreille lake, with the exception of a few prairie spots; with but little level intervale, the mountains sloping steeply towards the river, and abounding in wild, romantic scenery, especially where the river widens considerably, embracing numerous islands, with their growth of cottonwood. For the sake of the geography alone, it is to be regretted that none of the exploring parties visited the country directly north of Clark's fork and Pend d'Oreille lake. The Hudson's Bay people report a large and beautiful sheet of water called by them Lake Rootham, and surrounded by a wild belt of excellent country. (See a subsequent report from Lieutenant Mullan, of his exploration of Kootenaies river, exhibiting a highly diversified country, with the usual characteristics of the whole mountain section.)

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* Lewis and Clark's Travels.

The spurs of the Bitter Root and Cœur d'Alene mountains, depending from the southwest side of the great mountain feature, are but little known: only one party went through from the head of the St. Mary's or Bitter Root valley to the western plains; but this line of reconnaissance was so far from the general operations, that a considerable region on that side remains to be explored. (The subsequent explorations of this region leave but little to be said. The accounts of Lieut. Mullan, Mr. Tinkham, and Lieut. Macfeely, with the older explorations of Lewis and Clark, concur in proclaiming the wild and inhospitable character of the whole western district. Lieut. Mullan was the most fortunate, having found, he believes, a practicable railroad and wagon route through the Cœur d'Alene mountains.—See the several reports.)

One of the most singular results of the survey of the dividing ridge by the numerous passes is, that the barometer, wherever used, shows a marked difference of elevation between the slopes on either side, amounting to as much as five or six hundred feet, that being the difference of the observations taken at the heads of the streams rising on both sides at the very base of the ridge. Partial information led to the belief that these differences were all one way, so that the general base on which the mountains rest was supposed to have just so much greater elevation than any corresponding part of the eastern slope; but this has not proved to be the case: in Cadotte's or the Blackfoot Pass, the western is the higher side; in Clark's Pass, the eastern; the eastern also in Marias Pass; varying in the same way, it may be supposed, in the other passes where altitudes were not obtained.

From the data of such a rapid survey it is not possible, nor will it be considered necessary, to ascertain the precise arrangement of the smaller branches of the mountains on that principle of order which is known to obtain, even in the fantastic outlines of mountains and rivers. The extensive explorations of Mr. Tinkham, civil engineer, and Lieutenant Mullan, United States army, from the basis of the odometer survey, have developed the leading features with reliable accuracy, as they have been feebly indicated in this report. In accordance with the general view here attempted, it will perhaps be sufficient to observe that, although the whole region is generally pretty closely packed with mountains, still the *available* country in the valleys and prairies can be reckoned—it is not too much to say—by thousands of square miles, requiring only roads—the leading-strings of nursing nations—to develop its capabilities; and if the successful cultivation of mountain slopes and unpromising soils in densely peopled countries be considered, it will warrant the conclusion, that but an insignificant fraction of all the mountain country will prove unfit for some kind of useful purpose or improvement.

By way of further illustration, however, of these mountains and the various routes by which they can be traversed, a more detailed description will now be submitted of the line of the odometer survey.

Leaving Medicine or Sun river, the trail passes through two square-looking elevations, which seem as if they had been upheaved from the general surface to a height of about eight hundred feet, having a base each of at least a square mile, the table-land on the top corresponding with the surrounding country, and the almost perpendicular sides showing a regular stratification, such as, no doubt, obtains through this section generally. On the one to the northwest, the edge of the stratum of rock on the very top resembles a crown in some degree, on which account it was called "Crown Butte;" they are both called the "Big Knees" by the hunters. From these curious features, which may be considered the gate or entrance to the mountains by this trail, there follows a succession of every description of mountain country. For the first twenty-five miles the trail winds a devious course to the southwest, through innumerable, naked, and rocky hills of moderate elevation, with rugged outlines; and, crossing several small streams, leads to a defile on the south fork of Dearborn river, which is the entrance proper of the Blackfoot or Cadotte's Pass, as this point is accessible from other directions. On either side of this distance is a considerable extent of country in which the rocks crop out in every conceivable shape. In one case further progress is stopped, to all appearance, by an immense wall of rock, stretching from hill to hill across the ravine in which the train is moving. The guide, however, soon finds a narrow passage which admits one animal at a time, at the risk (which sometimes becomes a certainty) of tumbling into a deep muddy water-course which has its outlet here. In numerous instances the rocks project perpendicularly to a great height from the surface, and, from constant disintegration by the action of frost, the accumulating detritus forms a regular slope around the base, which has a very artificial appearance. One of the most remarkable of these is the "Bird Tail Rock," a pretty and appropriate name; it is probably not less than three hundred and fifty feet high, of which about one hundred and fifty feet of the upper half is a picturesque cluster of basaltic (?) columns, which attracts the notice of every traveller, and so straight that it baffles the most persevering efforts to ascend it. The writer and a companion made the attempt and arrived at a recess within about one hundred feet of the top: here was found the lair of some wild animal, probably a grizzly bear, judging from its size and the dung which lay about. It was perhaps a lucky circumstance for the visitors that Bruin happened to be "not at home."

The defile leading to the pass is ten miles through, in a course of southwest by south, and is walled in on either side by lofty mountains, whose steep sides are clothed almost to their summits with an impenetrable forest of every species of pine. From the sources of Dearborn river a steep and laborious ascent of over a thousand feet attains the dividing ridge of the Rocky mountains; and on the other side a more sudden descent of about six hundred feet leads into a similar defile, where, immediately at the foot of the descent, rise the waters that flow to the Pacific.

The view from the top of the dividing ridge should be often seen, to be well described, as every change of weather doubtless produces a corresponding change in the aspect of the vast scene. On the occasion of our crossing, although in the valleys the weather was mild and serene, on the top there blew a gale which well nigh took men and mules off their feet, and made it difficult to take a steady look in any direction. An endless succession of towering peaks and ridges stretched away into blue distance on every side, until the farthest outlines seemed indifferently to be clouds or mountains. The first snow had fallen and melted in the valleys, but still glistened in patches on the highest summits, giving them a sharp relief amidst the dusky pine-clad hills, that seemed to reflect their gloomy hues upon the sky; for although the sun was shining brightly, he seemed impotent to cast a cheerful ray upon the sombre and stormy mountain waste. At this great elevation there is probably always more or less high wind, which, with the tremendous view on every side, might well fill the untutored mind of the roaming savage with the idea that here must be the abode of the spirits of storm and destruction.

The Blackfoot fork of the Bitter Root river, which has one of its sources here, flows southwest by west for twenty miles through a narrow valley, which gradually opens to a width of four miles at its lower end, where there is considerable timber in the bottom; the trail, however, keeps the open prairie, which is unobstructed, except by the small affluents of the main stream. The valley suddenly closes to a narrow gorge, into which the waters, now swollen to the dignity of a river, rush with some force. Here was a considerable beaver swamp, and a complete dam across the river forcing the pent up waters into a side channel; this was the only specimen of the labors of that industrious animal which was seen upon this route. The trail follows the river through the gorge, crossing it several times, and, after twelve miles of the most difficult mountain paths—sometimes through thick and tangled brush, sometimes along steep and dangerous side-hill, then through a gigantic net-work of fallen timber, and often through the swift and deepening current—emerges at last upon one of the largest and finest of the mountain prairies. Enclosed all round by high mountains, as this and all the other prairies are, they appear to be of much smaller extent than they really are. Its greatest length nearly north and south is about twenty miles, by an average width of seven; thus containing certainly over one hundred square miles of good grazing land, with a gently undulating surface and numbers of small ponds, the river meandering through it, with timber and brush at intervals.

Geology must determine whether, as it occurs to almost every one, such prairies have been formerly the beds of mountain lakes; while a reflective mind takes pleasure in anticipating the time when the wild and exuberant beauties of such scenes shall receive the chastening touch of art, and be animated by the labors of a civilized and industrious community.

Crossing this prairie a point or two north of west, the route, and the river generally, continue in the same course for ten miles along the base of high and steep mountains on the south, and a considerable extent of prairie hills on the north ("Prairie of the Knobs," of Lewis and Clark;) thence through a small level prairie of a few miles in extent, surrounded, of course, by high mountains; thence, for thirty miles, a few points south of west in a deep, narrow valley, following the river where it can be followed, and meeting with every variety and difficulty of mountain path—narrow, level intervals, jutting rocks, thick-growing and obstructive timber, steep ascents, and rocky and dangerous side-hill. It would be a tedious if not a hopeless task to attempt to give in detail the striking and ever-changing scenery of so great an expanse of mountains; it is the happy privilege of the painter, only, to present at a glance the varied elements of the picturesque and sublime, which would soon grow tiresome in description, even if exact and vivid description were possible to such an extent.

After the last distance stated, a small stony prairie occurs where the Blackfoot fork joins the Hell Gate river, which then flows through a narrow opening on the west called Hell Gate, and debouches on the open valley of the Bitter Root, which, seven miles farther west, receives by two mouths the collected waters from the eastern ranges. The Blackfoot fork is the "Cockalahishkit or River of the Road to Buffalo" of Lewis and Clark; but why it should be so called is not very clear, for the mountain Indians go to the buffalo plains by several routes, of which the Blackfoot river is believed to be the worst and least used.

Some twenty-odd miles up the valley of the Bitter Root, which has already been sufficiently noticed, are the Flathead village of St. Mary's and the hospitable mud-walls of Fort Owen, occupied by the gentlemen of that name, independent traders with the Indian tribes, and setting a fine example of persevering industry in reclaiming and cultivating the soil, raising crops and cattle.

From the confluence of the rivers near Hell Gate the main route avoids the difficult part of the Bitter Root valley, turning on a course directly north about twenty miles through a picturesque defile to an extensive and fertile prairie on Jocko river, where numbers of wild horses were seen; thence northwest sixteen or seventeen miles, through the most varied and interesting scenery, to where the Jocko empties into the Flathead river, a stream as large as the Bitter Root, and sometimes supposed to be Clark's fork proper. This river comes from the north to this point, and turns directly west, with little variation for twenty-five miles, where it joins the Bitter Root at the opening of a mountain-bound prairie called Horse Plain. In the last half of this distance the mountains form a cañon on the river similar to that mentioned on the Bitter Root, at the commencement of which the route leaves the river and tends northwest nine miles through Camash prairie, which is the least attractive-looking of such spots; thence west again about nine miles through a rocky pass, and, by a steep descent, strikes the united waters at the foot of Horse Plain. Since the conclusion of the surveys in the mountains it appears that the two avenues to the valley of Clark's fork by what are called *cañons*, on the Flathead and Bitter Root rivers, immediately above their junction at Horse Plain, have not received the thorough examination to which their importance entitled them; it will not, therefore, be out of place to give in a few words a somewhat clearer view of their character, as amongst the principal topographical features of the whole mountain section.

They have been mentioned as cañons; but this expression must not be taken in the exact sense in which it is applied in purely volcanic regions, where unbroken perpendicular walls of rock, thousands of feet in height, are opposed to each other for many miles; but they come the nearest to this idea of any similar features in the mountain-basin in which they occur, and of which they are the natural outlet. Vertical walls are understood to occur for short distances, but in general the mountains crowd upon the rivers in rugged broken masses alternating with steep slopes and dense timber, the sudden and frequent windings of the channels being the most serious engineering difficulty. How far this character actually extends will require further and more deliberate examination to determine which is the more necessary, as, notwithstanding the facility of detour which is found higher up in the different branches of Clark's fork, still, from the configuration of the country, the manner in which the interior or spur ranges of the mountain-basin close upon these rivers above their junction, it is easy to perceive that all practicable routes concentrate to this particular point, with the exception of the route across the Cœur d'Alene mountains reported by Lieut. Mullan, but only as entitled to further examination. Thus the result of the whole examinations in this extensive basin is, that two practicable railroad passes are reported *into* the basin (going west) and two passes believed to be practicable *out of it*. The cañon on the Bitter Root was partially examined by Mr. Lander; that on the Flathead was not examined at all. They are both believed to be practicable at extreme cost.

In the next seventeen miles, a point or so north of west, the river now certainly called Clark's fork* winds through the deepest and narrowest part of the valley, the mountains on the south rising abruptly from the water, and heavily timbered; but on the north they project, in shapeless, naked masses, to an immense height, the frequent piles of fragmentary rocks giving evidence of some tremendous disruption; the whole range bearing the appearance of having been rent asunder by some giant force, while hanging rock and mural precipice stand in stupendous contrast to the bits of sward and timber on the river-banks and islands. About midway through this magnificent gorge lie the remains of the "Fallen mountain," over which the trail leads as the only chance to proceed; the rudest kind of horse-track which even an Indian would construct winds deviously on either side from top to bottom, from rock to rock, the interstices being partially filled up with the smallest fragments and detritus, but not so as to insure freedom from danger without the greatest circumspection. It takes half a day for a train of moderate size to cross, and this is rarely done without injury or loss of animals; indeed, it is still a mountain in its fall. At the end of this grand aggregate of everything that is sublime and beautiful in scenery, are a few square miles of sward and timber called Thompson's prairie, and here we pause once more to admire the noble prospect.

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* No effort was spared to obtain the Indian names; but they are so hopelessly unpronounceable, that not one could be retained, except that of Lake Kalispelm, or Pend d'Oreille; and Kalispelm is merely the beginning of the Indian name, which extends to ten or twelve guttural sounds.

This prairie is a succession of grassy terraces on the north from the river to the frowning mountains which enclose it, and which on the south rise steeply from the immediate bank; the slopes between the different levels are covered with timber, of which the youngest growth extends irregularly on the open plateaux. Standing on the river-bank and looking up the valley, the view embraces all the elements of grandeur and beauty that can be imagined in mountain scenery, and in an extent which an artist would choose for a single picture. Here, as in many places, the mountains close in upon the river, making a stupendous gateway to the open prairie, into which pours a brawling stream through one of the numerous gorges from the north. It is late in the morning when the sun overtops the crowded mountains and lights their deep recesses, gilding the autumnal foliage of the little islands, which derive additional beauty from their clear reflection in the still back water created by the meeting of the rivers; the massive outlines of the foreground are still enveloped in shade, while in the mighty opening, rocks and trees, and pool and torrent, are glowing in a blaze of light. Such are the scenes that reward the way-worn tourist throughout this great region, and it is almost sorrowful to reflect that the very purpose of our explorations will soon dispel the "enchantment that distance lends," when it will be no longer an event in life to have crossed the mountains.

The character of the valley of Clark's fork, from Thompson's prairie to Pend d'Oreille lake, has already been perhaps sufficiently indicated in the general review of the mountains. The course and distance are about sixty-five miles northwest, in the course of which the only new features are a few small cañons, as they may be termed, through which the river suddenly disappears, but soon emerging and meandering through the dense timber, and making several remarkable horse-shoe bends. Of the cañons, that called the Cabinet, about thirteen or fourteen miles from the lake, is rather remarkable, but wanting the interest of novelty to those who have seen the wonders of the mountains from their eastern base. The traveller through the valley frequently passes through tracts of timber where the tall trunks stand denuded of their limbs and foliage, scarred and blackened by destructive fires which are sometimes started by lightning, but as probably by negligence or the nefarious purposes of hostile Indians. It is one of the grandest sights by night to watch the progress of the fearful element through the close-grown trees; the hissing of the flames enveloping the green limbs; the crashing of falling logs, and the clouds of belching smoke that darken the star-lit sky; the lurid glare and fitful light, in which the outlines of the hills and woods are seen starting from obscurity into view, to sink again into thicker darkness: these, with all the minor concomitants of such a scene, make an impression on the mind which can never be effaced. Though these fires be so terrible in appearance, they are rarely of any great extent, as the mountain-spurs and jutting rocks, with the winding of the river, form impassable checks to the most furious fire; they are soon succeeded by a growth of young trees, and are of but slight importance, compared to the devastating effects of a fire on the prairies.

Among the few disagreeables of such a mountain trip is one, it should be hoped of rare occurrence, which perhaps may not improperly be mentioned here. While the studious observer of nature is feasting his imagination with the varied scenery of the mountains, he suddenly stumbles on the scalped remains of some poor Indian warrior, left hastily on his last battle-ground by his vanquished tribe, his horse having shared his fate, lying near by; horribly mutilated by obscene birds and beasts, the loathsome objects are found, it may be, festering in the sun or stiffened in the frost—the most deplorable evidence of the unceasing hostilities which seem to be the most important purpose of the red man's life.

At the end of the most thickly wooded section of Clark's fork is Pend d'Oreille lake, encircled by a zone of romantic hills of diminishing elevation, and dotted with a few lovely islands like gems upon the breast of beauty. It is of very irregular form, with a varied shore-line of rocky bluff and sandy beach, a large section of which exhibits unmistakable indications of iron. Going round the northern shore, a course is made across the lake to its outlet, of west-northwest, sixteen miles; thence about eight miles southwest to the Hudson's Bay crossing, to which the distance on the river is twelve miles. From the crossing to the 49th parallel the river is very little known. Lieutenant Arnold made a reconnaissance of the falls over which it pours into the Columbia; but no regular examination of the rest of the river from St. Ignatius to its mouth has hitherto been made; it is merely reported to be exceedingly rough and dangerous by the hardy mountaineers.

With respect to the character of the river channels, and their capability of improvement from Fort Owen to Vancouver, it will be sufficient here to refer to the daring adventures of Dr. Suckley and his little party, during their attempt to go the whole length of those important rivers in a single canoe. When that gentleman arrived at Vancouver, some time after the main parties, his lugubrious and forlorn appearance, in the fragments of a dragoon overcoat and the remains of party-colored blanket leggins, sufficiently attested what patient endurance his gallant efforts must have cost him; but his own lively journal should be allowed to tell the rest. It is to be regretted that the hardships he experienced should have made it impossible to render a more perfect survey of the Columbia; but it is hoped that his narrative, besides its general interest, will redeem whatever errors may subsequently be observed in his sketch of that river as it will appear in the maps of the expedition.

Leaving the crossing southwest by south, twenty-five miles across the easy summit between Clark's fork and Spokane river, through open timber to the beautiful plain called Cœur d'Alene prairie, where are found large bands of domestic cattle in the finest condition, belonging to different trading posts—the best evidence of the ease with which such places might be settled. It is the largest of the mountain prairies on the main route, and probably the most superior in any point of view; but having already indicated the general character of all these prairies, it will suffice to remark the decreasing elevation of the mountains in which it is embosomed, suggesting to the traveller that he is soon about to quit these scenes of nature's greatness. Twenty miles southwest along the edge of Cœur d'Alene prairie reaches Spokane or Cœur d'Alene river—(the doubts about the application of such names will be examined and cleared up for the final map)—sixteen miles, two points north of west to the crossing of the Spokane; after which, having made a steep ascent of five or six hundred feet in a few miles, two points south of west, through alternate wood and prairie, the mountains, though still in view, are actually passed, and then is beheld the first expanse of the Great Plain of the Columbia.

When the foregoing was written, the journal and map of Lieutenant Mullan's comprehensive exploration from Fort Owen to Fort Hall was received. The great extent of mountains and prairies embraced in this work, which was performed during the winter months, would call for a more extended notice, if they were not of such exactly similar character to those already mentioned here, with the exception of the large sage plains near Fort Hall; indeed, if there be any difference in the likeness of the former features, it might be inferred, from the impulsive and enthusiastic reports of that officer, that they were rather superior than otherwise to anything of the kind occurring in this report. His journal of that route abounds with interesting details which must necessarily be excluded from a sketch simply intended to embrace the general features; for if everything were included, connected merely with the subject of topography, a large and readable volume might be filled. From near the point where the dividing ridge of the Bitter Root mountains joins the main Rocky range, the latter sweeps around to the southeast, making a reverse curve and enclosing a smaller mountain basin, open to the east, its waters forming the Jefferson fork of the Missouri, and containing an area of about ten thousand square miles, of which one thousand may be reckoned for open and favorable country hitherto observed, embracing many beautiful and extensive prairies, of which the largest is the Big Hole prairie, (the Hot Spring valley of Lewis and Clark,) sending numerous tributaries to Wisdom river, and having an immense extent of excellent pasture.

In the exploration of this basin, Lieut. Mullan entered from the eastern fork of St. Mary's river, crossing the Big Hole mountains; thence about five days' march, traversing the extreme headwaters of Wisdom river and Jefferson fork, again crossing the main range to Fort Hall, (about one hundred miles through the well known sand and sage desert of the Snake River valley.) Returning, he crosses the basin again by a more easterly route, crossing the two streams mentioned about a day's march above their junction, his route leading almost wholly through prairie valleys of great beauty and reported fertility. Leaving the basin by a small branch of Wisdom river, he crosses the Rocky mountains for the fourth time, and enters the greater mountain feature already described by the South fork of Hell Gate river, on which he reports a more extensive district of open country than any before observed, and a considerable hot spring. He calls this broad valley the Deer Lodge prairie, which, from its great extent and reported advantages, will probably, when better known, dispute the palm of superiority even with the famous valley of St. Mary's.

The Blackfoot fork, St. Mary's river, Lou Lou fork, and the western slope of the Bitter Root mountains, with the Jefferson fork, Wisdom river, &c., were explored and described by Lewis and Clark; but those celebrated travellers having had no object beyond that of exploration simply, and having left no topographical data beyond general description, the recent more systematic explorations may be considered as essentially new, as they were absolutely necessary for any practical purpose.

The Great Plain of the Columbia, or Plateau of Spokane, as it has been called, is bounded on the north by those rivers, on the west by the former, and on the south and east by the Blue and Rocky mountains; it is about two hundred by one hundred and fifty miles in its greatest length and breadth, and presents such a curious variety of surface, that it has been alternately called a barren sage plain, rocky plateau, sterile waste, and sandy desert. A great deal might be said to show that it is either or all of these, but there can be no doubt that it possesses many points of interest which time only will develop. It contains numerous lakes and rivers, the latter flowing almost invariably in cañons of proportionate dimensions, from the great fissure which holds the Columbia to the little cracks in the surface peculiar to every streamlet. Large tracts contain little else than huge masses of columnar basalt, projecting to different heights, from ten to one hundred feet; extensive swales occur, covered with bunch-grass; and sometimes we pass through many miles of short rounded ridges and hillocks, arranged, as it were, in rows, and laid towards the same cardinal point; while near Wallah-Wallah are large fields of artemisia in deep sandy soil, the most unfavorable part of the whole route. As might be supposed, the best sections of the Great Plain are found in the immediate vicinity of the mountains, where a deeper soil accumulates from the wash of the hills; but the extreme western portion, near the Columbia, presents little else than a miserable desert of drifting sand, alternating with sage plains and naked volcanic rocks. The examination of the Grand Coulée by Lieutenant Arnold shows another instance of the little reliance to be placed in unauthorized reports; instead of connecting across the northwestern bend of the Columbia some seventy miles, and being, as might be supposed, the old bed of that river, it extends but twenty-five miles, with the form of an immense cañon, and then is soon lost in the general level of the plateau.

Not unfrequently on the rivers and streams the cañon walls disappear in rounded slopes, which open out into valleys and flats where moderate grazing is found, and sufficient of brush-wood and dwarf cedar, poplar, &c., for fire-wood, while in very extensive sections the bunch-grass affords pasturage that might be called abundant. The soil, which is mostly decomposed trap-rock, of various depths, but generally thin, cannot be denied to possess properties of productiveness; and on the swales it is vegetable mould, which only requires cultivation to prove its capability, while the rivers and lakes abound in fish, but the hungry wolf is the only tenant of the plain.

The region, altogether, however, is not very attractive in any respect, and can only be looked upon as a new field of enterprise when the more favored wilderness shall have been subdued to the ever-increasing requirements of civilization.

From the Spokane to where the Peluse joins the Snake river in a direct course across the plain is about ninety miles southwest, during which the route crosses numerous small streams, and through such bleak country as has been shortly noticed; thence about fifty miles southwest to Fort Wallah-Wallah, some ten miles below the confluence of the Great forks of the Columbia, and another important stage of our journey has been accomplished. It should be stated here, that the longest march without water on the nearest route to Wallah-Wallah was twenty-seven miles; but by taking a longer route, water can be had by much shorter marches.

The Columbia river from Wallah-Wallah down, its cañons, rapids, the Dalles, Cascades, &c., are too well known to require much notice here; they have long since received the polished touch of one of the most eminent and favorite of living writers, and, in connexion with the northern Cascade mountains, have just been thoroughly handled by the gentlemen of the western division. It will be sufficient to observe that the prairies south of the Columbia, over which the odometer survey was carried, are extremely hilly and sandy, with some artemisia, which, however, is not seen beyond the Umatilla; an occasional house being a cheering sign that our labors were drawing to a close. From this route the majestic outlines of the principal peaks of the Cascade range, north and south, are almost constantly in view, from incredible distances, glistening through the pure air in their mantles of eternal snow. Near the Cascades, as the principal rapids of the Columbia are called, the odometer *gave out*, as well as some of the animals, and the winter was too far advanced to renew the attempt to carry the survey to Puget sound. However, it is satisfactory to know that the survey, as it was first plotted, independent of correction by astronomical points, but connected by those of Captain Wilkes and Professor Nicollet, was only ten miles in error; being in excess, in a line of nearly two thousand miles, an error of only one in two hundred, while in latitude there was no error whatever.*

Going down the Columbia, the reason of the Cascade mountains being so named becomes apparent from the steep sides of that tremendous chasm through which the gathered waters seek the ocean. Foremost among the wonders that attract the admiring gaze of travellers are the numerous and beautiful little falls which pour from every crevice, at every height, and frequently from the very mountain top. The grand proportions of the mountains and the noble river deceive the eye with respect to distance, and surprise ensues that there should be heard no "sound of falling waters." As many as twelve of these fairy cascades can be counted within view in a single reach of the river. Some, descending from hanging rocks, are dissolved in spray less than half way down the fall; others steal down the crooked crannies of the mountain, never actually leaving their steep channels, in which they glisten like a snow-wreath; and not a few seem as though they were frozen on the mountain side, so regular and imperceptible is the motion of the water, and a telescope is necessary to prove that they really are what they barely seem to be. Most of them are but tiny threads of foam; but on turning a projecting and sheltering cliff, there is found another little beauty in a nook adorned by groups of evergreens, where the water pours over a broader ledge, and spreads into a veil such as Undine might have worn: gently waving with the undulations of the air, every drop yet appears so distinctly to the eye that we pause, though vainly, to hear it plashing on the rocks beneath.

From the Cascades down the Columbia in a steamer, and up the Cowlitz, it may be, in the *mail canoe;* finding little towns on the banks, and sleeping in houses every night, so that we believe we are getting into settlements once more. It is scarcely necessary to make more than a few closing remarks on a Territory where already nearly all the appliances of industry are actively at work amid a quickly-growing population, and whose productions begin to vie with those of any country in the temperate zone. It has no doubt been told in many different ways that the country west of the Cascade range and north of the Columbia, particularly around Puget sound, abounds in all the resources that contribute to the growth of States; that its dense pine forest, which is its most prevailing feature, is interspersed with valleys and prairies, many of them teeming with life and energy, and that it cannot be long before their hardy citizens shall assume the proud position of a sovereign State.

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* Subsequently, by comparison with Captain Wilkes's revised longitude of Wallah-Wallah, the odometer survey was found to be 4′ in excess, or about three statute miles.

It remains, therefore, but to take a farewell glance at those majestic mountains, some of which may even now be vomiting their hoarded fires.* We pause at every opening in the woods to admire the brilliant tints of slumbering volcanoes, or to watch a passing cloud empurpled by the sun, far below their lofty summits, and turn away reluctantly to complete our journey with the day. Towards the termination of the ride from the Cowlitz to Olympia the opening timber gives glimpses of distant waters, overtopped by the outlines of high mountains with whitened peaks. Emerging from the forest-depths, the mountain ranges of the Cape Flattery peninsula grow clearly into view; their snowy peaks and summits are seen gleaming in the mellowed splendor of the evening sunlight, and reflecting a radiant glow upon the placid bosom of the sound; putting an appropriate period to a long and eventful journey, and to this sketch.

I am, sir, very respectfully, your obedient servant,

JOHN LAMBERT.

Governor I. I. Stevens,
Chief of Northern Pacific Railroad Exploration.

2. Preliminary notice of the geology of the country explored by Dr. John Evans, geologist.

[This paper, sent from Washington Territory, where Dr. Evans was still employed in the field when the report of Governor Stevens was submitted, was lost on the route.]

3. Medical reports of Dr. George Suckley, assistant surgeon U. S. A., and Dr. J. G. Cooper, surgeon of the exploration.

DR. SUCKLEY'S MEDICAL REPORT FOR THE EASTERN DIVISION.

Fort Steilacoom, Puget Sound, W. T.,
January 4, 1854.

Sir: I have the honor to submit the following brief report concerning the health of the parties under your own immediate charge, operating between the headwaters of the Mississippi river and Puget sound, together with a few remarks concerning the character of the country passed through, and the prevailing diseases in the various Indian tribes seen on the route.

The whole line of march can be readily divided into five distinct sections, varying considerably from each other in soil, climate, and productions.

1. The prairie and coteau country between Sauk rapids and Fort Union, at the mouth of the Yellowstone river. The eastern two-thirds of this section was exceedingly level, abounding in lakes, ponds, and pools. The weather was generally clear and pleasant, the heat of a July sun being generally moderated by refreshing breezes. Dews at night very heavy. Vegetation rank.

The western third of this was principally through a coteau country, nearly destitute of timber. Lakes numerous, but many of them stagnant and saline. Dews very light. Vegetation more scanty.

The main party of sixty-seven persons, and the detachment of nineteen under Lieutenant Grover, were occupied in passing through this region from June 10th to August 6th, a period of about eight weeks. The health of all persons was excellent; not a case of malarious disease appeared; and the only cases of sickness which came under my notice were slight attacks of looseness of the bowels, produced by eating too heartily of buffalo meat, in addition to the use of saline water. These slight ailments yielded very readily to treatment, and but one man was prevented thereby from duty, and confined to bed. His illness was promoted and aggravated by his own gross imprudence. With proper choice of camping grounds we could nearly always obtain good water, and plenty of it.

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* A late mail announced that Mount Rainier was emitting smoke.

2. The route passed over between Fort Union and Fort Benton, by way of the valleys of the Missouri, Milk, Marias, and Teton rivers.

The command at this time numbered over one hundred persons, and the time occupied on the march was between August 8th and September 8th. The length of this part of the march was three hundred and seventy-five miles.

Three men came on the sick report: St. Louis, (teamster,) epileptic convulsions; Osborne, (cook,) partial paralysis; Sergeant Collins, (corps sappers and miners,) dysentery.

The two first mentioned would probably have been attacked with the above complaints whether they had been employed by the expedition or not. St. Louis had been subject to fits for several years. It was thought best to send him in a boat with a party which left Fort Benton for St. Louis, Missouri, under charge of Lieutenant Saxton. Osborne continued with the main party until it reached St. Mary's village. He then had another attack of the paralysis, and was left with the men under Lieutenant Mullan's charge. Collins's attack seemed to be owing to indigestion, and consequent diarrhœa, kept up and aggravated by riding on horseback. He was too unwell to proceed farther with the train, and was consequently sent down the river with Lieutenant Saxton. The health of the rest of the party was exceedingly good.

3—Contains that portion of our route between Fort Benton and Fort Colville, passing over and through the Rocky, Bitter Root, and Cœur d'Alene mountains.

This country is well wooded, and is abundantly supplied with swift running cold spring brooks. No cases of sickness occurred in the main command. At St. Mary's I was detailed on special service, which necessarily involved my absence from the main party until we reached Fort Vancouver.

Section 4, embraces our route through a country almost destitute of timber between Fort Colville and the Dalles; the health of the command still continued excellent.

Section 5. March between the Dalles and Puget sound, via Fort Vancouver.

This district is well wooded, and abundantly supplied with good water. Three cases came on the sick report as follows: The first was that of a mule-packer, who had contracted syphilis. The second was a case of severe acute articular rheumatism in the person of a dragoon private. This was produced by his lying out in the wet all night, during a fit of intoxication. The rest of the men were all healthy, except one of the gentlemen of the scientific corps, who became slightly indisposed in consequence of the sudden change from being in the open air, to in-door confinement at Vancouver.

On reviewing the whole route, the unequalled and unparalleled good health of the command during a march of over eighteen hundred miles appears remarkable; especially when we consider the hardships and exposures necessarily incident to such a trip. Not a case of ague or fever occurred. Such a state of health could only be accounted for by the great salubrity of the countries passed through, and their freedom from malarious or other endemic disease.

All the Indian tribes which came under my observation east of the Rocky mountains seemed free from epidemic disease, at least temporarily free. Their principal complaints are chronic inflammations of the eye and phthisis pulmonalis. Lues venerea and gonorrhœa prevail, to a certain extent, among the Assiniboins and Gros Ventres; but the Blackfeet proper, Piegans, and Blood Indians, as far as I could learn, are nearly exempt from these diseases.

The Indians seen between the Rocky mountains and Fort Colville belong to the Flathead and Pend d'Oreille or Kalispelm tribes. Owing to the good principles inculcated by the missionaries they are very virtuous in their habits; consequently syphilis is almost unknown among them. Phthisis pulmonalis is very common among them, especially among the last mentioned tribe.

They are very poor, and frequently suffer from scanty innutritious diet. As most of the members of both of these tribes have been vaccinated by the missionaries, smallpox is of rare occurrence.

The Indian tribes on the Columbia river, below Fort Colville, are rapidly becoming depopulated by the smallpox, intemperance, and syphilis. During the past summer the smallpox has prevailed in every direction, carrying off the natives by hundreds. The Lakemans and Wyampums, during this short period, buried more than one-half of their numbers.

In conclusion, I cannot too strongly urge the importance of some well-directed measures being instituted for the thorough and systematic vaccination of all the native tribes west of the Rocky mountains. Without requiring any additional argumentative appeal, common humanity and good sense plainly indicate the course to be pursued.

I remain, sir, respectfully, your obedient servant,

GEORGE SUCKLEY, M. D.,

A. A. Surgeon to the Eastern Division of Exploration.

Governor Isaac I. Stevens.

DR. COOPER'S MEDICAL REPORT.

Fort Vancouver, *December* 26, 1853.

Sir: In this report I shall consider, in detail, all the facts noticed in regard to the health of the party—the hygiene of the country, and the diseases prevailing among the Indians, with their remedies. The general health of the party was very good throughout the journey. No epidemics or endemic diseases prevailed; boils being the only disease that occurred very generally, probably in consequence of the warm weather and meat diet. Two men were discharged at the Yakima with diseases contracted before starting, and which the nature of their duties as packers, and daily riding, prevented a recovery from during a march. Disorders of the digestive organs were common, but readily yielded to treatment. Although almost every person in the command applied to me at different times for medicine or advice, the above were the only cases especially worthy of notice. Many of the medicines furnished to the party were found unnecessary, while others were very useful; and a few were not supplied which would often have been serviceable. Considerable loss occurred from breakage in consequence of the difficulty of conveying medicines in panniers on the backs of mules.

The country traversed from June to November appears to be very healthy in that season. The great dryness of the climate, and the perfect drainage of the country, prevent the prevalence of malarious disease in summer. No instance of endemic diseases of any other kind was met with not attributable to the mode of life and habits of the inhabitants. Of the diseases prevalent among the Indians, the smallpox was the most common and fatal in its effects. Whole tribes have been exterminated by it on the Columbia river, and we met with it among all those inhabiting the west and north sides of its upper branches. Nearly all the survivors were marked with it, and it was decreasing at the time of our visit. Vaccination had been tried by some white residents on the Okinakane river, but without effect. East of the Columbia, however, it had not yet appeared, and the principal tribes there had been vaccinated by the Catholic priests. No indubitable cases of the syphilis were seen east of the mountains, though it has prevailed very generally on the west side of the mountains. I saw cases of intermittent fever on the west side of the mountains, but none on the east. The Indians there, however, say that it formerly prevailed extensively, but suppose it was brought from lower down the river. I met with no disease of the digestive organs among them, and their unvaried diet of dry fish and berries does not seem to affect them. Chronic inflammation of the external eye, with opacity of the cornea, is very common, apparently caused by the irritation of smoke in their badly-ventilated huts. Blindness following smallpox was met with but rarely.

I saw an instance of curvature of spine in a boy of about fifteen years, then past remedy. Deformity of the hip-joints was not rare, probably in consequence of morbus coxarius. Fractures and dislocations of the limbs appear to be rare. The Indians are not much exposed to accidents of that kind, on account of their indolent habits and little taste for adventure. Atrophy of the muscles constituting the calf of the leg is almost a disease among them, in consequence of their infrequent use in walking; all journeys being performed on horseback or in canoes, even for half a mile distance. Consumption is common among them, in consequence of poor clothing and shelter, combined with the weakness of constitution, generally caused by a scanty and innutritious quality of food. Decay of the teeth seems to be rare, but they wear down from the surface, as in horses, &c., forming smooth flat tops.

I could learn of very few remedies among the Indian tribes; they are unwilling to tell of such as they have, which must be very few and of little value, as they place great confidence in the treatment and medicine of the whites. Many tribes on the upper Columbia and its branches use the hot vapor bath, followed by a plunge into cold water. This severe hydropathic practice does not seem to benefit them, and is fast giving way to other remedies. The huts used for its administration have been often described, and are used also east of the Rocky mountains. Like all savage nations, charms and incantations are much relied on by them. An umbelliferous plant (Pencedanum) is used by them as an emetic, as well as the root of the Sicyos Oregonus, or wild melon, which has properties similar to those of colocynth.

There are, undoubtedly, many plants indigenous to the country, of great medicinal value. Some of these are well known, but a long time will be required to ascertain fully the uses of the greater part of them. Some are noticed in the accompanying list of plants observed.

Respectfully, &c.,

J. G. COOPER, M. D.

Captain G. B. McClellan,
Corps of Engineers, Commanding Expedition.

B.

SURVEY OF THE CASCADES.

4. Railroad practicability of the Cascades and of the line of the Snoqualme Pass, by Captain Geo. B. McClellan, Corps of Engineers, U. S. A., in command of the Western Division.

[The survey of the Snoqualme Pass was carried by Captain McClellan up the valley of the Yakima to three miles west of the dividing ridge.]

Olympia, W. T., *February* 8, 1854.

Sir: I have the honor to submit the following report upon the practicability of a railroad across the Cascade mountains.

The result of the explorations of the last summer has been to ascertain that, between the parallels of 45° 30′ and 49° north latitude, there are but two passes through the range practicable for a railroad: that of the Columbia river, and that in which the north and main fork of the Yakima heads.

I will first describe the latter—heretofore erroneously called the Snoqualme, for the reason that the river of that name, the south fork of the Sinahomish, was incorrectly supposed to head in it.

The approach to this pass must be by the valley of the Yakima, crossing the Columbia anywhere within fifteen miles above the junction of these two rivers.

The Columbia here runs through a level and extensive sage plain, of a sandy soil; the approaches are perfectly good; the river about four hundred yards in width.

No material for bridging exists immediately at hand.

Excellent yellow pine grows abundantly on the Yakima, about one hundred miles from its mouth, and can be floated down at high water with but little difficulty.

Good granite is found on the Columbia, about one hundred and forty miles above the mouth of the Yakima: it may occur at a less distant point.

From the crossing of the Columbia to the commencement of the pine timber is a distance of ninety-six miles; the general character of the valley to this point is wide, open, and terraced; the ground of sand, gravel, or loose stones—but little clay, or vegetable mould; curves easy; long stretches of straight road, perfectly practicable. In this distance there are five points where the hills come close to the river; making, at most, ten miles of side-cutting necessary. This cutting is generally in earth, loose stone, or trap-rock, easily broken into blocks. In addition to these five points, the last eight miles of the ninety-six will be principally side-cutting in earth, gravel and sand—the work light, and no very high side-slopes. In the first eighty miles from the Columbia the grade will be twelve and a half feet to the mile; in the last sixteen miles it will be eight and a half feet to the mile. By keeping thus far the north bank of the Yakima, the only bridges of any consequence required will be two, over streams each about seventy-five feet in width.

At some place in this vicinity it would be advisable to cross to the south bank of the Yakima, which is here about forty yards wide; good crossing easily found; plenty of timber on the spot; stone for masonry within twenty-five miles by water. The road now keeps to the valley twenty-one miles farther on—four miles beyond Ksitkas; passing through an open pine woods; soil light, sometimes gravelly; about two miles side-cutting—grade eight feet to the mile. From the point now reached, there are two methods of passing the dividing ridge: 1st. By means of a tunnel four thousand yards in length, from the level of Lake Willailootzas, 2,993 feet above Vancouver; 2d. By a tunnel 11,840 yards long, from the level of Lake Kitchelus, 2,388 feet above Vancouver.

If the short tunnel be used, the road must, at this point, leave the valley, take a side location on the northern slope of the mountains bordering the valley on the south, and ascend eight hundred and ninety-five feet in eighteen and a half miles, giving a grade of 48.4 feet per mile, in fifty per cent. rock. The plateau of Willailootzas, one mile long, will be entered by a curve, with a radius of about two thousand feet, and the road pass along the north bank of the lake, with side location, in eighty per cent. trap-rock, easily worked. This lake should be partially drained; its shores are steep, and of broken stone. There will be some little difficulty in preparing a proper depot for the workmen, tools, &c., at the entrance of the tunnel. The tunnel, about four thousand yards long, will pass through solid rock, (silicious conglomerate) and will debouche on the western slope at an elevation of about three thousand feet above the sound at Seattle. The road must now have a side location on the mountain spur bordering the valley of the Nook-noo, in about seventy per cent. rock, generally conglomerate; follow this valley twenty-nine and a half miles, then take the summit and northern slope of the low ridge separating Lake Mowee from the valley of the Snoqualme, and from that taking a spur running from the Nook-noo falls to those of the Snoqualme, reach the latter falls at a distance of forty-five miles from the tunnel—all in side-cutting, with rocks as above.

The grade will be 59.8 feet per mile.

With reference to this stretch of forty-five miles, and that of eighteen and a half miles on the eastern slope, leading to the tunnel, it is to be observed that the grades given above are on the supposition that a continuous grade can be obtained; but it must be expected that the grade will necessarily be broken, and be higher than the estimate in many places.

From the Snoqualme Falls to Seattle is a distance of about 30 miles, of which the first ten must have a grade of twenty feet per mile at most; and the remaining twenty pass over a quite level country.

If, instead of a tunnel from the level of Lake Willailootzas, we consider a tunnel from the level of Lake Kitchelus, the case will be as follows:

Commencing at the point eighteen and a half miles east of Willailootzas, there will be eighteen and a half miles, with a grade of 15.2 feet per mile, and but little side-cutting, through a thickly timbered country, as far as Kitchelus.

The divide must now be pierced by a tunnel 11,840 yards long, of a character similar to the one considered above.

The grade to the Snoqualme falls will then be 46.3 feet per mile; all other circumstances unchanged.

These two methods of passing the divide are given as the only means that have suggested themselves to me, for overcoming the obstacles presented by the best pass north of the Columbia river. The elevation of the different points was taken with the barometer, from the eastward to a point about three miles west of the summit; the distances *estimated* by parties passing over the ground. It must be clearly understood that the statements just made are the results of a reconnaissance with no other instruments than a compass and barometer, and that they are given merely as the best approximations that could be made under the circumstances; liable to modification upon any future examination, made with more leisure and better instruments. Such an examination may prove the estimated length of the tunnels to be slightly too great, but will rather increase, than decrease, the grades as given above. The great difficulty in the case consists in the short distance available for effecting the descent from the summit to the sound.

During the past summer and fall, and the present winter, I, and the gentlemen of my party, spared no pains in inquiring of the Indians as to the quantity and nature of the snow in the mountains during the winter. We examined the snow-marks on the trees in the passes; in more than one instance our guides pointed out to us, far above our heads, where they, standing on the snow, had broken off branches from the trees.

All the information thus obtained from different sources, at different times, and various places, was perfectly consistent, and is fully sustained by facts known in regard to the Mt. Hood immigrant trail, the Sierra Nevada, Coast range, &c. We all agreed in the opinion, thus founded, that in ordinary winters there could not be less than from twenty to twenty-five feet of snow in the passes.

Mr. Tinkham having crossed the mountains by the main Yakima Pass on the 21st January, 1854, reports seven feet of snow in the pass. I have every desire to give this report its due weight, and think it can readily be explained by the fact that this has, thus far, been a remarkably dry season, and that perhaps the greatest amount of snow may usually be found in the mountains at a later period than this. In any event, I still remain of the opinion that, in ordinary winters, not less than from twenty to twenty-five feet of snow will be found in the passes during the most unfavorable months of the year.

With regard to the Columbia River Pass, I am not prepared to speak so much in detail. The last barometer being broken before we reached there on our return, and for other good reasons, I passed down by water. Mr. Lander, however, travelled the greater part of the distance by land; and as his examination corroborates the opinion I formed at the time, I shall content myself with expressing in general terms the nature of that pass.

The only tunnel required will be to effect the passage around Cape Horn mountain; this will not exceed seven hundred feet in length, and a close examination may prove even this to be unnecessary. There need be no gradient to exceed ten feet per mile; no trouble of any consequence is to be apprehended from the snow; the work will be prosecuted with much greater rapidity and economy—the supplies much more easily furnished than on the Yakima route.

The distance from the mouth of Snake river to Seattle, by this pass, is about one hundred and forty miles longer than by the Yakima Pass; considerable side-cutting in rock will be necessary. The road should follow the Columbia to the valley of the Cowlitz; and following that valley, take as direct a line as possible from the "Farms" to Seattle. The country is of such a nature that there will be no difficulty in obtaining suitable gradients; a great part of the distance from the Cowlitz Farms to Seattle will be through gravelly prairies.

From Wallah-Wallah to Seattle there will be but ten streams of any consequence to bridge; these bridges will not be of great length, nor will their construction present any unusual difficulties. As a matter of course, there are a number of rivulets to be bridged. It is unnecessary for me to enter upon the discussion of a question so generally understood as the economy of low grades and short tunnels, both as to the construction and subsequent use of a railroad; neither does it come within my province to consider these passes as to their positions with respect to the general line from the Rocky mountains westward, whether crossing by the South Pass or to the north of it. Having stated what I know about them, I have merely to consider their relative merits with regard to the physical obstacles presented by each.

I am of the opinion that the Yakima Pass is barely practicable, and that only at a high cost of time, labor, and money.

The Columbia River Pass is not only undoubtedly practicable, but is remarkably favorable. I see no reason to believe that an equally good one can be found anywhere through the Cascade range, or the Sierra Nevada; and have no hesitation in pronouncing it to be, by far, the best from 45° 30′ to 49° north latitude. The question is, after all, reduced to a choice between the shorter line, high grades, a very long tunnel, and almost certain difficulty from the snow, in one case; and the longer line, low grades, little or no tunnelling, and no trouble from the snow, in the other. I prefer the latter.

The main Yakima Pass giving quite a direct line from the mouth of Snake river to Seattle, it would be desirable that an instrumental survey should be made of it, as well as of the Columbia River Pass, should any more railroad explorations be made on this line. I have mentioned Seattle as the proper terminus of the road, whether it crosses the mountains by the main Yakima or by the Columbia Pass. This place is situated on Elliott bay, and is by far superior to any other harbor on the eastern shore of Puget sound—I mean here, by Puget sound, the sheet of water made up of the sound, properly so called, Admiralty inlet, Bellingham bay, &c.

Seattle is the nearest to the Straits of Fuca. It is easily entered with any of the prevailing winds, is secure from heavy seas, and has a most excellent holding-ground of blue clay, and good depth of water—thirty fathoms. The banks are suitable for a town; the deep water comes so near the shore that but very short wharves will be required. Semi-bituminous coal has been found within fourteen miles by water up the D'Wamish. The harbor can be defended by permanent fortifications.

Next to this place, Steilacoom is the best terminus on the eastern shore: it is not so accessible from the straits; it affords a fair harbor for large vessels; and the "Narrows," which cover this harbor, are more easily defended by permanent works than are the approaches to Seattle.

The examination of the passes of the Cascade mountains was necessarily limited to a hasty reconnaissance, for the reason that that range was almost wholly unknown—in fact, nothing whatever was known of the portion north of the Yakima Pass; and as I was under the necessity of completing the examination as far as the northern limits of our territory, I had no choice, but to ascertain, with the least possible delay, the most important facts with reference to each pass, and then push on in search of others.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieut. Engineers and Bvt. Capt. U. S. A.,
Commanding Western Division of Survey.

Governor I. I. Stevens,
Chief of Northern Pacific Railroad Exploration, &c.

5. RAILROAD REPORT OF THE PRACTICABILITY OF THE SNOQUALME PASS, AND THE OBSTRUCTIONS TO BE APPREHENDED FROM SNOW, BY MR. A. W. TINKHAM.

[Mr. Tinkham extended the survey from the point to which it had been carried by Captain McClellan to Seattle, on Puget sound, and made examinations of the depth of snow in the month of January, 1854.]

WASHINGTON, D. C., *June* 19, 1854.

SIR: By your direction I made a winter examination of the line of the Yakima in January, and, crossing the mountains by the Snoqualme Pass, carried the line to Seattle, on Puget sound.

The Columbia may be crossed near the mouth of the Snake river with a width of about four hundred and fifty yards. Crossing the Columbia, the line enters the valley of the Yakima. This river, in the lower part of its valley, has a width of some one hundred yards; flows with a steady current; is rarely fordable; for about forty miles from its mouth has no wood on its banks, other than the small willow and occasional poplar; and is bordered on either side by high rounded hills destitute of woods, apparently dry, and scantily covered with grass, and on whose slopes the underlying trap-rock is frequently exposed. These hills, at several intervals, touch upon the river for a short distance only, and again retire frequently several miles from the river, thus dividing the river-bottom into several separate and prairie-like portions, to some or all of which the Indians have given names. The artemisia, in the part of the valley near the Columbia, is abundant on the more elevated positions of the bottom lands, growing less as we ascend the valley, and finally disappearing altogether. After ascending some forty miles up the river, portions of the bottom lands of considerable extent are noticed, so little raised above the level of the river as to be frequently overflowed and marshy; are marked by a stout, lofty swamp grass, and are cut with occasional slough-like channels, which are perhaps dry and hard in summer, but in winter were wet and miry, and were avoided by the Indians with me.

For some one hundred miles up, the valley is extremely favorable; the rise of the valley is very small, (by Captain McClellan's observations an average of but about twelve feet per mile,) and the only expensive work to be encountered being the limited amount of rock-cutting where the hills close in upon the river in three places of about ten miles in length, and one or perhaps two crossings of the Yakima, with several other small streams. At the end of this distance the valley narrows, and the more broken grounds show that one is on the slopes of the mountains. To Lake Kitchelus, however, within a few miles of the summit, the rise of the valley, though more rapid, is still very gentle.

After the distance of forty miles spoken of as destitute of wood, the river is generally lined with cotton-wood, the pine occasionally mingling with the latter wood, and becoming more numerous higher up the valley.

By my own estimate the summit of the pass is one hundred and fifty-five miles from the mouth of the Yakima. At a distance of about one hundred and five miles from the mouth the line has entered the more open borders of the extensive wooded district, reaching thence to the shores of Puget sound. On the east slope of the mountains, pines, spruces, firs, cedars, larch, and some small amount of unimportant hard-wood trees, are the general growth; on the western slopes the mass of the growth is as elsewhere on the sound, fir and cedar.

As might be supposed, the obstacle to be overcome in this important route, presenting much that is promising, and demanding in the future surveys the most careful attention, is the passage of the summit with suitable grades. The saving of distance in the Great Trunk line, connecting the Mississippi and the great lakes with the Pacific, is so considerable as to warrant a large expenditure to overcome the natural obstacles of the route.

Captain McClellan obtained barometric observations, giving a profile of the route from the mouth of the Yakima to a point three miles west of the summit. From this point westward, to the ocean, no connected observations have been made.

To present clearly the result of my own observations, I will refer to the two methods suggested by Captain McClellan for passing the summit:

1. By means of a tunnel, 4,000 yards (2.27 miles) in length, from the level of Willailootzas, about 3,000 feet above the sound, with an eastern approach of eighteen and a half miles with a grade of 48.4 feet per mile, and western descent of forty-five miles at 59.8 feet per mile.

2. By a tunnel 11,845 yards (6.73 miles) long from the level of Lake Kitchelus, 2,388 feet above Vancouver, with an eastern approach of eighteen and a half miles with a grade of 15.2 feet per mile, and a western descent of forty-five miles at 46.3 feet per mile.

These estimates suppose a uniform grade for the distance given, and, as is remarked by Captain McClellan, the grade will necessarily be broken, and higher than the estimate in many places.

Being without instruments or snow-shoes, and on the coldest days of winter, it was impossible for me to carry a profile down to the sound, or to investigate the best mode of passing the mountain; but I think that the lower tunnel might be shortened some, and I observed that while the distance between the summit and Wallah-Wallah is nearly as I made it, the distance between the summit and the sound is much less.

From about the level where the tunnel at the water-level of Lake Kitchelus would debouche on the western side, I judged that the natural descent of the valley of the Nook-noo was sixty feet per mile, and that it soon became less than this. I think that from this point westward no serious difficulty exists, and the balance of the road to Seattle may be made without objectionable grades, or work of an unusually expensive character. Although the explorations of this route are still very incomplete, my own meagre examinations are sufficiently conclusive to establish the practicable character of the country between Seattle and the Snoqualme falls.

One of the objections to this route, of serious importance, if existing, is, that in winter the Yakima valley is much obstructed, and the mountain summit impassable from the depth of the snows. The exploration which, by your direction, I made from Wallah-Wallah to Seattle, was principally for the decision of this question; and I give in brief its results.

The trip from Wallah-Wallah to Seattle occupied the greater part of January of last winter, and just as I was preparing to leave Wallah-Wallah the weather suddenly changed and became severely cold, and the passage of the mountains was made in the coldest days during the winter, a winter of greater cold on the Columbia and Puget sound than is usual.

I found no snow in Yakima valley until, on January 13th, about seventy miles from its mouth, the snow was from two to three inches deep. To this point I found the Indians, in large and small camps, scattered along the banks of the river, the two largest camps being forty-eight and sixty-six miles distant from its mouth. These Indians had grazing with them large bands of horses and some cattle; were in their permanent camps, and evidently, with their experience and perfect acquaintance with the winter, had in the fall prepared for the occupation of their winter camp, where I found them, without the expectation that the snow would drive them thence, or destroy their horses and cattle.

Ninety miles from the mouth of the river, January 16, the snow was three or four inches deep; the grass was good, and the small number of Indians here had a few horses grazing near this camp. Thenceforward the snow slowly increased, until, sixty-five miles farther on, on the 21st of January, I crossed the summit of the Yakima Pass with a depth of snow of six feet for a few miles. Fourteen miles west of the summit the snow was but eight inches deep, mostly the deposit of a snow-storm occurring during my passage of the mountain, and thence rapidly diminished, at the Snoqualme Falls being an inch or two deep, and so, protected by the trees, just covering the ground, continued nearly to the shores of the sound, where was neither snow nor ice.

For about six miles on the summit the snow was found to be six feet deep, with an occasional depth of seven, as also of four feet. Eighteen inches to two feet of this fell on the night preceding the day on which I crossed the divide. The whole was light and dry like a mass of feathers, and the snow-shoes sunk through the fall of the preceding night, burying themselves nearly two feet, and making the travelling very laborious. The weather, while making the passage of the mountains, was generally clear and very cold. Immediately after reaching the western slopes the weather became milder, soon damp, and finally, after passing Snoqualme Falls, rainy.

The whole breadth of snow over twelve inches deep was some less than sixty miles in extent. Of this about forty-five miles were two feet and upwards; about twenty miles were four feet and upwards; and six miles were six feet and upwards.

All of the snow was light and dry; it was the accumulated snows of the winter to January 21, deposited in successive layers of from a few inches to two feet deep, which had generally lain undisturbed since their fall; and they present little obstruction to removal in comparison with the compact, drifted snows of the Atlantic States.

The Yakima Indians with me, who were well acquainted with the route both in summer and winter, cached their snow-shoes only eighteen miles west of the summit, to be used when they went back to their country. They could not return there until as late as February 10, and evidently, at that place, expected no increase of snow during the interval of their absence.

I see no well-grounded reason to apprehend that the regular running of railway trains would be hindered in winter from the snow in the Yakima Pass.

My exploration was made for the purpose of getting the winter condition of the pass; and, as you are aware, I had no white man with me. I had previously been obliged to abandon my barometer and thermometer. I had with me only a pocket-compass, and, under the difficulties with which all such winter explorations are attended, could accomplish little more than what I have here set before you.

From opinions of the route while passing over it, I think it probable that, with the shorter tunnel proposed by Captain McClellan—2.27 miles in length—we shall be able to pass the summit with eighty-feet grades for a limited distance, say fifteen miles, or seven and a half miles ascent and seven and a half miles descent.

I am, respectfully, your obedient servant,

A. W. TINKHAM.

Governor I. I. STEVENS,
In Command of Northern Pacific Railroad Survey, &c.

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6. REPORT ON THE RAILROAD PRACTICABILITY OF THE PASS OF THE COLUMBIA RIVER, BY MR. F. W. LANDER, CIVIL ENGINEER.

OLYMPIA, WASHINGTON TERRITORY,
January 5, 1854.

SIR: The high floods to which the Columbia river is subject are serious obstacles to obtaining the best location for cheap construction offered by its valley. From the danger to be apprehended from them, it will be necessary to place the bed of the road at some distance above the ordinary level of the water, and thus incur the need of cutting deeply in many spurs and ledges. I am of the opinion, however, that the general grade of the road will not exceed ten feet per mile; and the facilities for borrowing from the debris of the neighboring ledges a material needing no tool but the shovel, and the long stretches of prairie and bottom land that occur where an embankment road-bed may be used, protected from the action of the water by the simple means of placing the weightier material at its natural slope on the outer edge, will materially reduce cost.

At eastern prices, the whole of this work, with the due amount of protective material, could be constructed at fifty cents per cubic yard; and, when built, would be unequalled in the grand points of facility of drainage and preservation of superstructure.

It may become necessary to tunnel the mountainous point termed Cape Horn. Passing this point by water, I was not able to obtain so fair a view of the opportunity afforded for the adjustment of the line in deflection to avoid it, or the severity of the changes of direction needed in curvature. I shall report more fully in regard to this matter after a careful examination on my way back.

On so important a line as the proposed Pacific railroad, I should not recommend curvatures of less than two thousand feet radii, or a reverse within five hundred feet of the tangent point, save in extreme or nearly impracticable cases, which the latter is not. The tunnel would not exceed seven hundred feet, and would cost, at eastern prices, say sixty-five dollars per lineal foot—a high estimate, when the character of the ledge is considered. The length of this tunnel, working both faces, does not hinder its construction in a short space of time; and I am by no means certain that it is absolutely necessary.

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The greater facilities for applying large forces of laborers upon the river line, and thus forwarding it to an early completion, is an important item in obtaining a result; for the use of the rail in carrying supplies into the interior bears very fully upon the question of location for the first five hundred miles of the line, and will rule the cost of those portions of the route at a distance from communication; therefore, as abundant means of transportation as exist, by the navigable waters of the Columbia, should give their aid by artificial means for reaching the far interior, where leagues of prairie and many miles of shallow open cuttings will be ready for the rail before the great summit sections of the mountain passes are excavated. Contractors will study these questions very fully, as they materially influence both the cost of the road and the time of its completion.

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You have directed me to estimate upon a bridge across the Columbia, at some point between Vancouver and the Cowlitz, for the purpose of affording the valley of the Willamette railroad communication with the terminus of the route by the Snoqualme. It is impossible to arrive at even an approximate estimate of the cost of such a structure until the width of the river at the favorable point is ascertained, the distance across the flats and their quality, the depth of soundings both of mud and water, the force of current, the effects of ice in spring freshets, &c., all of which must direct in planning the mode of bridging.

I believe, however, that the river is shallow, and that a plain bridge of piling can be safely used for a large portion of the distance. Near the centre, by the aid of the coffer-dam, good piling foundations should be obtained for substantial piers of heavy masonry, and a few spans of Howe's truss give free passage to the water. I should think the probability of danger from ice in freshets, either in lifting, piling, or crowning, not sufficient to deter us from attempting such a mode of structure; and, supposing the conclusions to be correct at the present rates of labor upon the Columbia, the prices of the work would range as follows, viz:

First-class piling structure, at 80 cents per square foot, on upper bridge surface, for a road-bed of 20 feet, is per lineal foot of road $16—5,000 feet (piling)..........	$80,000
Howe's truss, at $60 per foot, 400 feet..	24,000
Draw and appendages..	25,000
Two first-class, large wing abutments; three deep-water piers and foundations; materials for masonry transported on road from Puget sound, which cost, say $40 per perch..	80,000
	$209,000

The Columbia can be bridged at the Cascades, and at several points above the Dalles, without obstructing navigation. * * * * * * * *

I am, with respect, your obedient servant,

F. W. LANDER.

Gov. I. I. STEVENS, *Chief N. P. R. Exploration and Survey.*

C.

GENERAL REPORTS OF THE SURVEY OF THE CASCADES.

7. GENERAL REPORT OF CAPTAIN GEORGE B. MCCLELLAN, CORPS OF ENGINEERS, U. S. A., IN COMMAND OF THE WESTERN DIVISION.

OLYMPIA, W. T., *February* 25, 1853.

SIR: I have the honor to submit the following report of the expedition under my command. The instructions under which it was conducted will be found appended to this report.

I arrived at Fort Vancouver on the 27th of June; but it was not until July 24 that the party fairly started.

The season being late, our progress slow for the first few weeks, and the northern half of the range being entirely unknown, it was impossible to make more than a mere reconnaissance of the different passes, and it became necessary to push on towards the north, to determine whether any existed in that direction.

Supposing that there would be less timber on the eastern than on the western slope of the range, and that the elevation of the plateau between the Rocky and Cascade mountains would facilitate our progress, I determined to gain the eastern slope as soon as possible; and then, moving as close to the mountains as practicable, strike in with small parties whenever a possibility of finding a pass presented itself.

Originally, I intended to follow the valley of the Columbia as far as that of the White Salmon, and to reach the eastern slope by following the latter valley. In consequence of the high stage of water in the Columbia, that trail was not yet practicable when we were ready to move. Being informed that there would be but little difficulty in following a trail direct from Vancouver to Mount St. Helen, and there cross the mountains, I determined to take that route.

My party consisted of Lieut. J. K. Duncan, third artillery, astronomer, topographer, and draughtsman; Lieut. H. C. Hodges, fourth infantry, quartermaster and commissary; Lieut. S. Mowry, third artillery, meteorologist; Mr. George Gibbs, geologist and ethnologist; Mr. J. F. Minter, assistant engineer, in charge of courses, distances, &c.; Dr. J. G. Cooper, surgeon and naturalist; Mr. A. L. Lewes, assistant engineer and interpreter; five assistants in observations, carrying instruments, &c.; two sergeants, two corporals, and twenty-four privates of fourth infantry—one sergeant being the quartermaster and commissary sergeant; one private doing duty as blacksmith. Six privates, whose terms of service expired shortly after we started, being employed as packers, the number of the escort and working party was reduced to three non-commissioned officers and seventeen privates. Two chief packers, three hunters and herders, and twenty packers, completed the party, which thus numbered sixty-five persons besides myself.

Guides we took from place to place, as we could find them; for even among the Indians there were none who knew more than small portions of the country we traversed. There were 173 animals with the command; 73 for the saddle; 100 for packing. Of the whole number, 46 were mules. The mules were generally very excellent; some of the horses good, but the greater part very indifferent Indian horses; the best, however, that could be procured at so short a notice. The pack-saddles with which we started were in part sent from San Francisco, partly purchased from the Hudson's Bay Company; they were alike worthless. Fortunately, there were about fifty of the old-pattern Ringgold saddles at Vancouver, which we obtained; they answered admirably. As it was, we were greatly delayed by the frequent breaking of the others.

The size of the party may seem too large; but from the nature of what little information we possessed at the time in reference to the country we were to traverse, the disposition of the Indians among whom we were to travel, and other circumstances which need not be mentioned, it seemed that the number was as small as it ought to be; especially when the practicability of detaching small parties was considered.

The packers were divided into brigades of two; each brigade having charge of from four to six animals.

The command was armed with rifles and a few of Colt's revolvers. The supply of instruments consisted of one sextant, a very good one; two chronometers—one indifferent, the other worthless; one level, a good instrument; one surveyor's compass, indifferent; two Schmalcalder compasses, good instruments; two syphon barometers, good instruments; two syphon barometers, quite inferior; two aneroid barometers; two hygrometers; four thermometers. These instruments were sent out in charge of Lieut. Duncan, before my arrival in Washington from Texas.

Our only means of determining the longitude was by the method of lunar distances; the variation of the needle by the Schmalcalder compasses.

I will endeavor to make this report as brief and general as possible, referring to the accompanying documents for details.

The topography of the country will be found in Lieut. Duncan's map and memoir.

Mr. Minter's itinerary will show the obstacles met with on the march, daily distances, &c. For the meteorology and barometric profiles, I refer to Lieut. Mowry's reports and drawings.

Mr. Gibbs's reports give the geology of the country and everything relating to the Indians.

The natural history and hygiene of the country are discussed in Dr. Cooper's reports.

Ascertaining that the trail was obstructed by brush and fallen timber, I started in advance on July 22, with a small working party, leaving Lieut. Duncan in charge of the main party, with instructions to overtake me as soon as possible. I awaited the command at Yahkohtl; they arrived there on the 28th July. We were delayed at this place until the 31st in making new pack-saddles to replace those broken in this short distance.

On the 1st of August we reached the Cathlapoot'l, followed its valley until the 5th, on which day we left it and crossed the dividing ridge.

From Vancouver to the Cathlapoot'l there is but little to invite settlement. With the exception of a few small tracts, the country is generally covered with dense forests and thick undergrowth; the trees often attaining an immense size. Fir is the predominant tree; a few scattered cedars, oak, ash, elder, and maple, are met with. There could not well be a more abundant growth of berries than we found in this district: among them may be enumerated three kinds of the huckleberry—blue, purple, and red; the blackberry, raspberry, thimble-berry, gooseberry, service-berry, salmon-berry, sahlalberry, and the Oregon grape; the wild cherry and hazle-nut also were seen. The valley of the Cathlapoot'l above, and at our crossing, is utterly worthless for any purpose. On the Yahkohtl river there are some three or four cascades, which may hereafter be of some value as water-powers.

At the second camp after leaving Cathlapoot'l river, (Taunkamis,) we halted one day, our animals having suffered much from the almost entire absence of grass for four days. On the 8th we reached Chequos. On account of the animals I remained here two days, and occupied the time by taking observations, examining the vicinity, &c.

From the mountains, near camp, there was a fine view of the country for a long distance in every direction; five large snow mountains were in sight—Rainier, St. Helen, Adams, Hood, and Jefferson. The mountains in this part of the range are generally wooded; they have steep slopes, but seldom present bold or rocky outlines. Forming an opinion from the confused nature of the mountains, and the courses of the streams, I thought the possibility of finding any suitable pass near St. Helen too slight to justify me in delaying here to make a more detailed examination, and determined to push on towards Mt. Rainier with as little delay as possible. A fair pack-trail might be made from Chequos to near the head of the Puyallup or Nisqually. From the Cathlapoot'l to Chequos, the country is mountainous and sterile.

On the 11th August we left Chequos, reaching Atahnam on the 17th. Soon after leaving Chequos the country assumes a new character; the yellow and pitch pine, with a few oaks, become the predominant trees; the woods open, but little underbrush is seen, and the blue bunch-grass makes its appearance. The soil is of the lightest character, and is but a few inches in depth, the whole of this portion of the country being underlaid by a sheet of lava. After travelling five days through a rough and timbered country, we, on the 6th, emerged from the woods into a barren country entirely destitute of timber. With the exception of narrow strips in some of the valleys, this district presents every indication of absolute worthlessness. In the Simkwe valley we first saw the wild sage; prairie wheat and dwarf sumach also occurred here, and were frequently seen afterwards in the valleys. None of the streams crossed between Chequos and Atahnam presented valleys that could give passes through the range.

On the 17th August we encamped on the Atahnam, one and a half mile above the mission; next day I visited the mission, and found there the Rev. Fathers Pandozy and d'Harbomey, with a lay-brother. The Atahnam mission is inhabited only during the summer; in winter they establish themselves on the main Yakima, not far from the Columbia, the snow being less deep and the cold less intense in the latter situation. Here, on the simplest fare, with few or none of the comforts of life, with no society save that of the savages, these men are content to pass their time in endeavoring to extend their religion, and improve the morals of their savage neighbors. I would here express my obligations to the priests for the cheerfulness with which they afforded all the information in their power, and their personal kindness to all the gentlemen of my party. At the mission, I was informed that a party of citizens were engaged in cutting a road through the Nahchess Pass; that this road was nearly finished, and that the old Indian trail to Steilacoom was practicable in four days. As there is but a scanty supply of grass in the Atahnam valley, I determined to move forward to the Wenass, a more central position, and affording abundant grass, there to make the new arrangements now become necessary.

Accordingly, having spent two days at Atahnam in obtaining information as to the country and Indians, jerking beef, &c., we started on the 20th August, and reached the Wenass on the same day. Finding that valley to be a suitable depôt, I proceeded immediately to prepare the parties necessary to accomplish the purposes in view. On account of the uncertainty of the time necessary to examine the range, and the possibility of being caught near the northern boundary line by an early winter, I did not think it prudent to leave the Yakima for the north with less than three months' provisions. I determined then to send in for a sufficient supply to insure this, while the examination of the mountains in the vicinity was in progress. From the information we received with regard to the road through the Nahchess Pass, it seemed certain that Steilacoom could be easily reached in five days: in addition, a reconnaissance of that line was important. That route was therefore selected for the provision train, and Lieutenant Hodges was detailed to command that party. Long before this it had become evident that our pack-horses were unfit for the service required of them, and there seemed to be good reasons for believing that there were many public mules at Fort Steilacoom; I therefore sent in no pack-mules, but all our pack-horses, with Lieutenant Hodges, giving him directions to exchange them, if possible, for mules.

Lieutenant Hodges started from Wenass on the morning of the 22d with a party, consisting of Mr. Lewes—discharged at his own request on account of the necessity of his attending to some private business of importance—one non-commissioned officer, five privates, seventeen packers, and two employés, discharged on account of incapacity. Fifty pack-horses and the necessary saddle-animals accompanied this party. Lieutenant Duncan was directed to leave Wenass on the 24th, with a party of three men, to cross to the main Yakima, examine the upper part of that valley, and obtain all possible information in relation to the surrounding country, especially to the north. Mr. Gibbs was directed to examine the valley of the Yakima to its junction with the Columbia; to leave on the 25th, with one man and a guide. With Mr. Minter, and six men, I started on the 23d to examine the Nahchess Pass. The remainder of the party, with the animals, were left in camp at Wenass, under charge of Lieutenant Mowry. On the 22d we received a visit from the priests, accompanied by Kamaiahkan, the principal chief of this country; they spent the night with us, and on the next morning I had a long "talk" with Kamaiahkan, at the close of which he received a handsome present. He expressed very friendly feelings, and I have no reason to doubt his sincerity, for, in a number of instances, he displayed an honesty not often found among Indians.

Having finished the talk with the chief, I started to overtake my party, which had moved off some two hours before me. The trail led up the valley of the Wenass, for a few miles, and then crossed to the Nahchess. At the distance of a mile above the main camp the Wenass valley becomes quite narrow, the hills closing in; the grass continues good; the valley destitute of timber, with the exception of the usual scanty fringe of cotton-wood and willow, until the trail leaves the main and passes up a lateral valley covered with an open growth of yellow pine. About half a mile above our camp were some quite large and good potato patches; indifferent corn and melons are also cultivated here by the Indians. Above this point the soil appears to be quite poor. The ascent of the dividing ridge is long and broken, but never very steep for any long distance, although the elevation of the summit is great. The mountains are generally covered with yellow pine, never thick, nor with much underbrush; sometimes they present tracts of bare lava. The descent to the Nahchess is quite steep, and is generally wooded with the same timber. The soil on the divide is of the most inferior quality. We encamped this day about half a mile from the Nahchess, on a small spring branch. I will now, for a moment, omit the description of the Nahchess valley as we travelled up; merely state that on the 25th we reached and encamped upon the summit, and then take up the description of the valley from its junction with the Yakima, without reference to daily marches.

To the distance of some twelve miles above its mouth, this valley varies from one mile to two miles in width, with one or two low terraces. There is no timber here; the fringe of bushy cotton-wood and willow being too insignificant to deserve the name. When the valley is not covered with volcanic stones, it is, to all appearance, of the most miserable soil, generally covered with wild sage, and having but little grass. The hills are quite precipitous where they border the valley, and increase in height as they approach the main range. At the distance from the mouth above mentioned, the character of the valley undergoes an entire change. The hills by this time become mountains, close in upon the stream, so that the valley from here to the head is reduced, as a general rule, to a mere cañon, occasionally widening out for short distances. The stream winds with very sharp curves. The cañons are often, for a mile or two in length, occupied to their whole width by the stream. The walls of these cañons frequently rise vertically to the height of 400 feet, the mountains coming boldly down to their edges. The walls are of solid rock—generally trap, or a compact igneous rock. The Indian trail is a very bad one—avoiding the valley, and keeping to the mountain-sides, where the ground is very stony; the ascents and descents long and steep—so much so, that it would not be possible to construct a wagon-road along the mountain-sides at any reasonable expense. The road would, therefore, be forced into the valley, and necessarily be located at times in the water, besides requiring an almost endless number of crossings. Independently of the impossible grade necessary near the head of the valley, the amount of side-cutting in rock, embankment, sharp curves, deep cutting, and short tunnels, would render the construction of a railroad too difficult and expensive, if not impracticable. The timber (yellow pine) commences in the valley, about eighteen miles from the mouth. For some distance it is open, and, with the undergrowth, thick only in places. The nearer the divide is approached, the thicker the growth becomes—the underbrush and fallen logs more troublesome—and the yellow pine gradually gives place to the white spruce, balsam-fir, &c., until, near the summit, it disappears. In all the openings of the valley the grass is good. Some fifteen miles east of the summit there is a chain of small marshy prairies, with excellent grass; and upon the mountains immediately south of the pass are some five or six prairies of a larger size, and similar nature, through which the trail passes. It may be well to mention here, once for all, that the Indian trails in these mountains seldom follow the valleys; they generally keep to the higher ground, where the woods are less dense; for the Indian prefers riding over a mountain, to the labor of cutting a trail over more level ground. In other words, he has more consideration for himself than for his horse.

The largest fork of the stream joins that up which the trail passes about 25 miles from the summit, and heads directly in Mt. Rainier; its valley is even more difficult than that of the trail. The elevation of the lowest point of the divide, above Vancouver, is 4,890 feet. In the last seven miles of the valley the ascent is 229 feet per mile. From the summit of the mountains, bordering the pass, there is a fine view of Mt. Rainier. Exceedingly massive, it presents, from near the pass, the appearance of a long ridge with two peaks; the eastern one being rather the higher, and more rounded of the two. At a short distance above the snow-line there is a belt of jagged cones, extending the whole breadth of the mountain. Between the pass and Rainier, as well as to the west, the mountains are generally covered with timber; to the south and southeast, they are frequently bare of trees, quite rough, and with more or less snow upon them in August; but to the northward there is a vast sea of bare, jagged, snow-crowned ranges extending as far as the eye can reach.

Proceeding westward, the trail soon descends by a very precipitous route into the valley of Green river; follows that as far as its juncture with the White river, (they form the S'kamish, or south fork of the D'Wamish,) and keeps to the S'kamish valley, about ten miles farther. To the point where the trail leaves this valley the country passed over is all of the same nature. The descent for the first twenty miles from the summit is very abrupt; the valley very narrow, much like that of the Nahchess, except that it is much more heavily timbered. The mountains approach the stream so often that frequent crossings are necessary.

Portions of the S'kamish valley are very boggy; grass is almost entirely wanting for a distance of at least fifty miles from the summit. From the S'kamish to the Puyallup, the country is a high plateau, much broken up by ridges and mountains. It is densely timbered with fir, but interspersed with prairies, the soil of some of which is good.

The descent into and the ascent from the valley of the Puyallup are long and steep. From Puyallup, towards the Nisqually, the country is elevated, and although somewhat rolling, is by no means so rough as the section last described. This also is densely timbered and interspersed with prairies, which assume a more grave and sterile character as the sound is approached. The crossings of the streams on this trail are bad; the current being rapid, and the bottom covered with loose and rounded stones.

Having satisfied myself of the impracticability of the Nahchess Pass for a railway communication, I returned and reached the depot camp at Wenass late on the 29th.

On the 31st I received a note from Lieutenant Hodges, in which he informed me that he had arrived when it was written, on the 27th, within twenty-five miles of Steilacoom; that he had been three days without grass, and was out of provisions; that sixteen horses had already broken down; that there were no mules to be had at Steilacoom; and that it would be perfectly impossible for him to bring out the number of rations I required. He desired instructions.

I at once determined to send in the escort and reduce the party to the minimum, and wrote to him by an Indian express to that effect; also, directing him to discharge a certain number of his packers.

Lieutenant Duncan returned about noon of this day, 31st, from the upper Yakima; Mr. Gibbs late in the afternoon, from the lower Yakima. Early on the 2d September, Lieutenant Mowry started for the Dalles with seventeen men, of whom but two were to return with him; he took in all collections made up to this time, and everything that could be dispensed with.

On the 3d of September the depot camp was moved from the Wenass to Ketetas, on the main Yakima. On the morning of the 4th I left camp to examine the pass at the head of the main Yakima, with Mr. Gibbs, Mr. Minter, and six men. The camp was left under the care of Lieutenant Duncan, with directions to employ his available time in examining the country in the vicinity. I reached and encamped upon the divide late on the 6th. Although a somewhat detailed description of the valley of the Yakima is given in my railroad report, dated February 8, and it is described for a portion of its length in Lieutenant Duncan's report. I will here describe the nature of the line, that it may the more readily be compared with the description of Nahchess Pass contained in this same report.

The Yakima unites with the Columbia in a vast sage desert, extending to the north and northeast as far as the eye can reach; and the desolate, dark gray color of the sage is unbroken by the verdure of grass or trees. The Columbia is here about four hundred yards in width, with sand and gravel banks thirty feet in height; a placid current; here and there a cluster of willow bushes border the stream, usually destitute of vegetation. In the Yakima, at its mouth, are three islands covered with good grass—all that is to be found in the vicinity. Neither stone nor timber occurs in the neighborhood. The valley of the Yakima soon becomes more contracted by low hills, which gradually close upon it, and soon increase in height as the stream is ascended. To the commencement of the pine timber, a distance of nearly one hundred miles from the mouth, the average width of the valley is about six miles, occasionally reduced to four or five hundred yards by spurs closing in on both sides, and sometimes widening out to ten miles. Cotton-wood and willow fringe the stream; grass is generally confined to the water's edge, but is not in sufficient quantity to adapt the valley to grazing purposes on a large scale. In some of the small lateral valleys good bunch-grass is found, as well as on the summits of the highest ridges and hills. But the winters are too severe for cattle to thrive in the open air, the whole country being covered with snow; and, in addition, the bunch-grass is of too scanty a growth to be cut for hay. During the winter the Indians drive their horses and cattle to the most sheltered spots, where they feed on wild sage and willow.

As far up as Ketetas the wild sage covers the valley in all parts a little back from the water. The general character of the soil is sandiness, or exceeding lightness; occasionally gravelly, or covered with loose stones. It might in many places answer well for small grains, when compared with the greater part of the territory. By reference to the map, it will be observed that Mr. Gibbs returned from the mouth of the Yakima to Wenass by a trail to the north of the river valley. From the point where he left the Yakima, his trail passed through a wide valley for some twenty-four miles; this valley is somewhat undulating and is very barren, being almost entirely destitute of grass, having no timber, but one little pool of water sixteen miles after leaving the Yakima, and that brackish; it is covered with the usual growth of sage. The trail then enters a cañon with basaltic walls, and gradually ascends until the summit is reached, in about eight miles. Grass occurs near the summit; also, a few small pools of brackish water. The trail now gradually descends towards the west into a broad valley, which unites with that of the Yakima. In this valley the grass is good; there are a few small pools of brackish water, but no timber. This trail is not practicable for a railway, but would make a good wagon road, were it not for the absence of wood and scarcity of water. The upper forty-five miles of the valley are wooded with yellow pine, gradually replaced towards the summit by white spruce, &c. The width is considerably less than below, averaging from one to two miles; it is always wide enough, however, to make a good road, perfectly practicable, although it is at present much obstructed by fallen timber and dense underbrush. Occasional prairies afford an abundance of grass for travelling purposes to near Lake Kitchelus. The soil is less sandy and more gravelly than below.

By reference to the map it will be seen that the Yakima and two of its branches head in lakes. These are surrounded by rough and lofty mountains, rising directly from the water's edge, and many of them having snow upon them in August. The lakes are apparently of great depth; the large salmon are found in most of them at the proper season.

But a short distance above Lake Kitchelus—above its foot, rather—the trail leaves the valley and passes westward over a very steep and lofty mountain, a portion of the dividing ridge. The pass is through a gorge at the foot and to the north of this mountain. At the summit of the pass, which is here about one hundred yards wide, there is a small lake, some two hundred yards long, fed by numerous springs, and surrounded by good grass. In this little lake two streams have their source; one is the head of the Nooksâi Nooksâi, which runs into the D'Wamish and Puget sound; the other into Lake Kitchelus and the Yakima, first passing through a lake nearly one mile long, called by the Indians Willailootzas. To the northward of the pass the mountains are very lofty, generally bare at the top, often of solid rock, with sharp outlines, most of them with considerable snow upon them. As far as the eye can determine, there is no possibiliy of effecting a passage in that direction; and there certainly is none between this and the Nahchess Pass.

The descent from the pass towards the west is down the narrow, steep, and thickly-wooded valley of the Nooksâi Nooksâi, bordered by rough and high mountains. At the distance of about twenty-five miles from the pass the stream empties into Lake Nook-noo; a sheet of water some four miles in length, at the foot of which there is a considerable fall. The stream then passes through a thickly-timbered and quite level country, into the D'Wamish, which empties into Elliott bay near Seattle. This country will be described more in detail in another connexion.

Before leaving the subject of the main Yakima Pass, it should be stated that there is a foot trail leading from the head of Lake Kitchelus to the head of the south fork of the Snoqualme. The Indians represent this as practicable on foot with the greatest difficulty, and that it is seldom used, although much nearer the Snoqualme Falls than by the ordinary horse trail; in fact, there is no trail, properly so called—merely a possibility for an unencumbered and active man to get through there.

The size and shape of the mountains seem to verify the truth of their statement. More detailed information as to the nature of the pass, the nature of the Yakima river, the quantity of snow, &c., will be found in my railway report of February 8, already referred to. The quantity of snow in the pass is there stated at from twenty to twenty-five feet; the data for that conclusion are there given, and are still believed to be reliable.

Lake Willailootzas is subject to rises of some fifteen feet above its level at the time we visited it. Its outlet is subterranean in low water and makes its appearance some three hundred yards from the lake; when the lake is full it passes over. About a mile below Lake Kitchelus the Yakima (or Yah-inse, as it is here called) is some twenty yards in width and about two feet deep, flowing with a rapid current over a bed of cobble stones. The banks are of gravel and about ten feet high; the river does not appear to overflow its banks; it gradually increases in size until, at Ketetas, it is about forty yards wide and three feet deep at the fords; near the mouth it becomes about one hundred yards wide at low water. In many parts of its course it is divided by sand and gravel bars into several channels, and is liable to great rises in the spring. According to the Indians, the snow is knee-deep at the mouth in severe winters; at Ketetas, to the middle of the thigh in ordinary winters; for some miles before reaching the mountains, it is six feet deep; in the gorges and passes, from twenty to twenty-five feet; and in peculiar localities, even more. In the timbered country the snow-marks seemed to prove the truth of these statements.

Having completed the examination of the pass, as far as the time at my disposal would permit, I rejoined the main party at Ketetas on the 12th September.

On our arrival at camp we found some of the party in a high state of excitement; they had found gold in small quantities on the margin of the stream, and were most industriously seeking for more. The fever soon abated, as the returns were not very remunerative. During our absence a large Yakima village had sprung up near our camp; it was the band of Owhai, one of the very best Indians with whom we met during the trip.

Lieutenant Mowry had returned from the Dalles on the 10th. I will condense from his report a description of the country over which he passed.

As already stated, he moved from Wenass on the 2d; he followed the trail passed previously over by the main party as far back as some three miles beyond the Sahpeniss, with the exception of crossing the divide between the Atahnam and Simkwee, opposite the mission. From the Atahnam to the Dalles there were three trails; the most eastern is the longest—leaving the Atahnam near its mouth, and making a large bend to the eastward—but it is the only one practicable in winter. Of the other two, the most western is the shortest and best in summer. Lieutenant Mowry followed this last trail. Leaving our old trail at a point three miles south of the Sahpeniss crossing, the Dalles trail passes for half a mile through open woods, then for a quarter of a mile through the northern extremity of a fine prairie; on leaving which, it again enters the open woods and ascends a difficult hill some fifteen hundred feet in height; then over a rolling country, and descends into a second prairie about two and a half miles from the first. Lieutenant Mowry describes this prairie as extending a considerable distance to the south and east; as being covered with excellent grass; as having a fine spring near his camp; and as possessing the richest soil he had seen in the Territory. For the next twenty-four miles the country is covered with open woods of pine and spruce; occasionally small prairies are met with, which, as well as the woods, furnish a thin growth of bunch-grass for the first seventeen miles; in the last seven miles the grass disappears. Four small streams are crossed in these twenty-four miles. The country is generally a high, rolling tract; the trail, during the last few miles, skirts the western slope of a lofty range of hills. The remaining distance to the Dalles is destitute of timber, with the exception of a strip half a mile broad, at the distance of about ten miles from the Columbia Immediately north of this strip there is a fine prairie, varying from two to four miles in width, several miles long, covered with excellent grass, and watered by a fine stream. On this prairie stands a good log-house, belonging to Skloo, brother to Kamaiahkan, and one of the principal chiefs of the Yakimas. South of this last strip of woods the country is at first rolling, and then sinks into a prairie, which extends to the base of the range of high hills bordering the Columbia. Good bunch-grass exists as far as the foot of the range, which is very high, exceedingly difficult of ascent and descent; much broken by cañons, outcropping of basalt, and has but a scanty growth of grass upon it. During the three days that elapsed between my return to Ketetas and Lieut. Hodges' arrival, several small parties were engaged in searching the neighboring streams for gold, examining the country, &c.; no rich deposits of gold were found.

On the 16th September Lieutenant Hodges arrived from Steilacoom. He brought with him twenty-nine pack-horses loaded with provisions. He was eleven days on the march from Steilacoom to Ketetas. Had it been possible to foresee the length of time necessary for the train to return from Steilacoom, a longer time might have been bestowed upon the examination of the Yakima Pass. I regretted that it should be so short, but felt obliged to retrace my steps in time to reach the depot camp about one day after the probable time of Lieutenant Hodges' arrival; besides, I at that time hoped to find a better pass than the one in question, farther to the north.

It being now determined to send into the Dalles all the indifferent animals that could, under the new arrangement, be dispensed with, the 17th and 18th were employed in arranging packs, &c., and in making the preparations for the main party to move northward and the spare animals to be sent in. On the 19th September I despatched one corporal, one private, (just discharged,) and one civilian packer to the Dalles, in charge of thirty-two miserable horses. On the same day the main party moved to Nahnum, at the northern edge of Ketetas valley.

The command now consisted of thirty-six persons, including myself; forty-two riding animals; fifty-two pack animals.

The animals were mostly a good deal recruited by this time; the train in good order; the party well armed, and supplied with about seventy days' provisions.

On the morning of the 20th we commenced the passage of the mountains between the Yakima and the Columbia; this range, which from the valley of the Yakima seemed but an ordinary ridge, proved to be a difficult mountain range. We had expected to find the country north of this range rather level, or, at most, rolling and covered with open pine woods. Our surprise may be imagined when the view spread before us from a commanding point, a little below the summit, is described. Five thousand two hundred feet below us lay the Columbia, apparently almost at our feet: so small and insignificant did it appear, that we could not believe it to be the "Great river." In front of us the Cascade range extended directly to the river, crossing it in fact; so that, to the north and west, there was nothing to be seen but mountain piled on mountain—rugged and impassable. About west-northwest was a handsome snow-peak, smaller than Mount Baker; as it is not to be found on any previous map that I know of, and had no name, I called it Mount Stuart. Far in the distance to the northward was seen a range, running nearly east and west, alongside of which the Columbia flows before reaching Okinakane. That portion of the Cascade range which crosses the Columbia sinks into an elevated plateau, which extends as far as the limit of vision to the eastward—this is the Spokane plain. On it we could see no indication of water; not a single tree, except on the mountain spur; not one spot of verdure. It was of a dead, yellowish hue, with large clouds of black blending into the general tinge. It appeared to be a sage desert, with a scanty growth of dry bunch-grass, and frequent outcroppings of basalt. Descending by a very steep trail, we reached the valley of the Columbia on the 21st. Through a valley about a mile in breadth, in which not a tree is to be seen, and seldom even a bush, and which is bordered by steep walls of trap, lava, and sandstone, often arranged in a succession of high plateaux or steps, the deep, blue water of the Columbia flows with a rapid, powerful current; it is the only life-like object in this desert. The character of the valley is much the same as far as Fort Okinakane. It occasionally widens out slightly; again it is narrowed by the mountains pressing in. Sometimes the trail passes over the lower bottom; at other, over very elevated and extensive terraces; and in a few places over dangerous points of the mountains. At one of the latter, three miles above the En-te-at-kwu, two of our mules were instantaneously killed by falling over a precipice, and two others seriously injured. The difficulty of the trail at this point may be imagined from the fact that we were occupied from 11 o'clock a. m., until dark, in passing the train over a distance rather less than two miles.

In this portion of the valley a few small groves of pine are met with; but the general character is entire absence of trees and bushes. In places only is the grass good; but we found no great difficulty in so regulating the marches as to obtain enough for the animals. The soil is so very sandy that it is not probable it can ever be applied to any useful purpose. Granite, gneiss, and syenite, occur in the valley in large quantities, and of excellent quality. At the time of our visit the Columbia was 371 yards wide just above the mouth of the Pisquouse; at the camp of September 23d its width was 329 yards, the surface velocity 3.6 miles, mean velocity 2.9 miles per hour; at the camp of September 24th the width was 330 yards, surface velocity 3.45 miles per hour; mean velocity 2.94 miles per hour. These velocities were taken at points where the strong current is near the shore; we had no means of reaching the middle of the stream, so that the velocities as given may be a little less than the true velocity.

The beach between high and low-water mark is composed of rounded pebbles.

From the vicinity of the Yakima Pass I saw the rough mountains in which the Pisquouse heads; from the divide between it and the Yakima we saw the country through which it runs. From the inferences thence drawn, and the accounts of the Indians, as well as the nature of the valley near its mouth, it appears certain that there can be no pass at its head for a road.

The next stream worthy of notice is the En-te-at-kwu. This has so small a valley—a mere ravine in fact—as to cut off all access to the dividing ridge in that direction.

The next water-course is that issuing from Lake Chelan. It is a short stream, formed of a succession of cascades and rapids. The lake itself is some thirty miles long, and is shut in by high mountains, which leave no passage along its margin; the mountains at its head will be alluded to in connexion with the Methow river. Before leaving the subject of this lake, I will state that the ascent from the valley of the Columbia to Lake Chelan could not be accomplished by a railway without an inclined plane, even were there a good pass up its valley.

On the 27th September we reached Fort Okinakane, and encamped on the Okinakane river, about one and a half mile from the fort, and not far above the site of Astor's old trading-house.

The fort consists of three log buildings, surrounded by a stockade in the form of a square, with block-houses at the extremities of one diagonal. But little business is now transacted here. It is in charge of Mr. Lafleur, the "garrison" consisting of two Kanakas. The post is situated on the river bank, and on the edge of the plain between the Okinakane and the Columbia. Neither grass, nor bushes, nor trees are to be found around the fort—nothing but bare sand and gravel; it is evidently located with a view to the convenience of passing boats, and with no reference to the comfort of its unfortunate occupants.

Riding with Mr. Lafleur to the summit of the mountain behind the fort, I obtained a good view of the Cascade range. The mountains came down to the Columbia and Okinakane, crossing the latter, and all rough and sharp. Mr. Lafleur informed me that there was no pass between Mt. Baker and the Hudson's Bay Company's trail from Okinakane to Langley. This our subsequent examination verified. The information received here confirmed me in my previous intention of examining the Methow river, for they told me there was a good foot trail leading up that valley and over to the sound.

Leaving some of our most fatigued animals and many of our loads to the care of Mr. Lafleur, we left the camp on the morning of the 28th. On the 30th we encamped upon the Twitsp, the south fork of the Methow. I was by this time quite certain that this route would not answer for a railway, but determined to keep on upon the same trail myself until the question could be fairly settled. Lieut. Duncan was directed to return to the forks with the main party, and to examine the main stream with a small party, following it as far as it was practicable. On the 31st I followed the valley of the Twitsp about four miles above our camp; here the stream forked, the north fork rising a few miles farther on in a high, bare ridge of granitic mountains; the south fork, Nahai-el-ix-on, coming down a narrow and precipitous ravine. Our trail led up this ravine.

Before proceeding much farther the valley became impassable for animals. I then went forward on foot until there was no longer any doubt as to the impracticability of the route. The barometrical profile will indicate the results.

The trail is said to pass from this ravine, over a very difficult country, to the stream emptying into the head of Lake Chelan, then to cross very steep and lofty mountains at the head of that stream, and finally to reach the Skagitt river on the western slope.

The results of Lieutenant Duncan's reconnaissance were equally unfavorable. On the 4th of October we reached Fort Okinakane, returning by the valley of the Methow to its mouth. During both our visits to Fort Okinakane we were treated with the greatest kindness by Mr. Lafleur, and we are under many obligations to him for his courtesy.

On the 5th October we left Fort Okinakane, followed the valley of the Okinakane river, and on the 9th reached our most northern camp, about thirteen miles south of the "Great Lake," in latitude 49° 26′; the weather, unfortunately, did not permit observations at this point, so that the latitude could not be determined with exactness. From its mouth to the forks the Okinakane valley is generally a wide one; in a few places it so much contracted as to force the trail over spurs, but as a general rule we passed over wide terraces. The soil is light, the grass generally good, and no timber in the valley. There is a fall of inconsiderable height thirty miles above the mouth; quite a number of rapids occur, but they are seldom bad. No stream of any consequence enters the Okinakane from either side below the forks; so that there is no possibility of there being any pass through the mountains between the Methow and the Millakitekwu, (the west fork,) especially as the mountains become very high and rugged a short distance back from the valley.

The Millakitekwu may be said to have no valley; for it runs through an immense ravine, with a cañon of great depth bounding the bed of the stream. Its nature is such as to render it impracticable for a road of any kind. The descent of this stream is rapid; at five miles from the mouth is a pretty fall of probably ten feet: as we were obliged to view it from an elevation of some three hundred feet, we could form no correct estimate of its height. There are no trees in this ravine; its soil is of sand and gravel.

The valley of the Sahtlilkwu (east fork) is generally a broad one, but is almost entirely filled with lakes and marshes. As far as the Great lake it presents a route practicable from the Columbia, with difficulties at some points; as it leads to nothing, and communicates with no pass to Frazer's river, it is not a subject for consideration. The Hudson's Bay trail from the Okinakane to Fort Langley leaves the Sahtlilkwu a short distance above our camp of the 8th, and after crossing a mountain ridge enters the valley of the Millakitekwu, follows that for a considerable distance, and then crosses the mountain into the valley of Frazer's river. It is represented by all who have travelled it as an execrable and just practicable trail, as following no *pass*, but crossing directly over the mountains.

On the tenth I left the main party in camp, and with all of the officers and two of the gentlemen rode to the Great lake, returning the same day.

Upon an attentive consideration of the more important points of what has already been said, I think it will be very evident that there is but one pass through the Cascade range, from the Columbia to the northern boundary—that of the main Yakima—that is at all practicable for a railway; nor am I aware of any reason for believing any to exist between that boundary and Thompson's river.

In the event of any future surveys of the Cascade range for railway purposes, the whole force may safely be thrown upon the main Yakima Pass and that of the Columbia. I now considered the most important part of my duty performed, having carried the reconnaissance of the Cascade range somewhat into British territory. The winter was now close at hand, the weather becoming cold, and the snow increasing rapidly in the mountains. Our animals showed unmistakable signs of the effects of their very difficult service, and the pass of the Columbia was still to be examined. As nothing but geographical information could now be gained by a longer delay in the mountains, I determined to leave the range and move for Colville. The route selected was that from the forks of the Okinakane to the head of Ne-hoi-al-pit-kwu, or Colville river, and down that stream to the Columbia; a portion of the country known only to the employés of the Hudson's Bay Company. I hoped on my arrival at Colville to receive some intelligence of the progress of your party, or even to meet you in person by a lucky chance.

It was also my determination, if nothing had occurred making it necessary for me to keep on to the Rocky mountains with the whole or a portion of my party, to make an examination of the country in the vicinity of the Grand Coulée, the approaches to the mouth of the Yakima, &c., and finally to return to Vancouver by the *trail* down the Columbia valley.

On the 11th we turned back; left the Okinakane on the 12th at the forks; reached the head of one branch of the Ne-hoi-al-pit-kwu on the 13th, and arrived opposite Colville on the 17th. This trail is impracticable for a railway, although a wagon road could be carried over it, with considerable difficulty, at some points. The soil in this district was the best we saw. Fine larch trees abound.

Soon after our arrival in camp opposite Colville, Mr. Angus Macdonald, the gentleman in charge of the post, came over to our camp, and kindly undertook to provide the canoes necessary for crossing our baggage next day.

By midday of the 18th all our stores and baggage were safely landed on the left bank of the river, and all of our animals had crossed in safety. Three small canoes, two of them of birch bark, were the only ones available. We encamped at an excellent place about half a mile from the fort. At the place where our animals swam the river, the current is very rapid and the river very deep; it is a good crossing for animals passing from the right bank to the left, but very dangerous for any crossing in the opposite direction. The valley of the Columbia is here well timbered with yellow pine, and is by no means so rough and forbidding as near Fort Okinakane. The fort is situated somewhat back from the river bank, in a pocket or widening of the valley. Of all the Hudson's Bay posts in this Territory, Fort Colville stands next to Vancouver in size and importance. The soil in the vicinity of Colville is better than it generally is throughout the Territory; but it is said to be soon exhausted. Not a particle of information had been received at Colville in regard to any of your parties. When I had about made up my mind to push for St. Mary's with two or three men, I was agreeably surprised by your arrival on the 18th. Every possible kindness was extended to my party by Mr. Macdonald. Coming thus under your immediate orders, I of course abandoned my original intention as to the completion of the expedition, and merely carried out your instructions.

I left Colville on the 22d, and reached a camp on a small branch of the Spokane on the 26th. As you remember, we were here joined on the 28th by Lieutenant Donelson, with the main party of the eastern division of the survey.

Leaving this camp on the 30th, I crossed Lewis' fork on the 4th November, having followed the same trail as that taken by Lieutenant Donelson up to this point. The crossing was effected without the loss of either animals or baggage—in perfect safety. From this crossing I took a different trail to Wallah-Wallah from that followed by Lieutenant Donelson; we passed by Dr. Whitman's old mission. This trail, though somewhat longer than Lieutenant Donelson's, is a much better one; the first march to water is much shorter. We reached Wallah-Wallah on the 7th, and left next day for the Dalles, following the river trail as far as the Des Chutes crossing. Reached Fort Dalles on the 15th November.

The description of the country from Fort Colville to the Dalles is fully given in Lieutenant Duncan's report, and will doubtless be found in your own report as well as that of Lieutenant Donelson; and as it is by no means an unexplored country, I have not thought it necessary to touch upon the subject. Upon arriving at the Dalles, my animals were too much worn out to be able to carry loads down the river trail at that advanced state of the season; the rains had already set in at Vancouver: for these and other reasons I determined to send the animals down without loads, and to take water transportation for the party.

The animals started on the 17th; the party in the small steamer Allen on the same day. We reached the Cascades that evening, and arrived at Fort Vancouver late in the night of the 18th November, having come down from the Cascades in open boats. It rained heavily during the whole of our passage. The animals reached Vancouver in six days from Fort Dalles. Two were drowned in crossing a creek not far from Vancouver; their condition on their arrival was such as to prove that they could not have accomplished the trip with loads. In my railway report will be found my opinion of the Columbia River Pass. At Vancouver my party was broken up, and the portion required for office work was sent to Olympia.

Being greatly delayed in making arrangements necessary for the disposition of my own and other parties, it was only on the 16th December that I arrived at Olympia, by way of the Cowlitz. On the 23d I left Olympia, with Mr. Minter and a small party, for Steilacoom, in a canoe. My intention was to endeavor to complete the barometrical profile of the main Yakima Pass, and examine the approaches on this side. At Steilacoom I found it impossible to make any arrangements for land transportation—the Indians representing the road impracticable for animals at that season; I therefore determined to proceed by water to the falls of the Snoqualme, and thence as far as it might seem advisable on foot. I left Steilacoom on the 29th with two canoes, reached the mouth of the Sinahomish on the 1st January, and arrived within a mile of the Snoqualme Falls on the 7th January. We proceeded but a few miles above the falls on foot; the trail was entirely obliterated; no Indian could be induced to accompany me to the pass as a guide. The barometer with which I was furnished had proved entirely worthless; and from the information obtained, there seemed to be no possibility of proceeding farther than Lake Nook-noo; I therefore concluded that no object would be attained by keeping on, at all commensurate with the difficulty of the undertaking, and determined to retrace my steps. The Indians represented the snow to be up to the arm-pits at the Nook-noo, and as increasing thence to the pass, at the summit of which it would be found to be about twenty-five feet in depth. Mr. Tinkham found but seven feet at the summit on the 21st of January; yet I am of the opinion that in the most unfavorable portions of ordinary winters the statement of the Indians will be found to be quite near the truth; at all events, I do not think that any important conclusion should be based on the results of Mr. Tinkham's trip; they ought to be verified later in the year, and, if possible, during a winter not so unusually dry as this was up to the time of Mr. Tinkham's passage. For a winter station, with the object of examining the depth of snow, the prairie at the foot of the Nook-noo falls would be a proper position.

The valley of the Sinahomish and Snoqualme is of pure sand, covered with an inch or two of decomposed vegetable matter, with the exception of a small prairie on the right bank of the Snoqualme, some ten miles below, and a larger one about two miles above the falls

There may be more of these small prairies of which I heard nothing. Some are said to exist on the Skywhamish. The bluffs of the stream are generally of sand, clay, and gravel; occasionally of conglomerate and argillaceous rock.

If there is any coal near the Sinahomish it will probably be found at some distance from the river, in a bluff about twelve miles from the mouth. The timber in the valley is generally poor; it principally consists of cotton-wood, maple, and alder: the fir and cedar are generally very indifferent; in some small tracts they are good. The bottom is usually wide, flat, and subject to overflow. There are extensive cranberry swamps near the mouth of the Sinahomish. This stream has three outlets, and has formed a low, sandy delta. The Sinahomish is navigable for small steamers for about twelve miles from its mouth; it forks about eighteen miles from the mouth, the Skywhamish being rather the larger fork of the two. Below the forks the average width of the Sinahomish is some fifty yards. The Snoqualme is much obstructed by rapids, which increase in number and strength as the falls are approached. I estimated the height of the falls at from one hundred and thirty to one hundred and fifty feet; they are exceedingly beautiful. The ledge over which the river passes at this point is of conglomerate. Similar falls exist at the foot of Lake Nook-noo, on the Skywhamish, the Stoluqnamish, and Skagitt. On the 12th we encamped on the head of MacDonough's island, intending to proceed to Bellingham bay; but during that night six inches of snow fell, and during the next day so violent a gale blew from the north that our canoes could not proceed. On the 14th we turned back, and reached Olympia on the 21st of January. During this trip the weather was intensely cold, the thermometer being as low as zero; we endured some discomfort from snow, cold rains, and sleet.

Before I left Vancouver for Olympia, Mr. Gibbs went to Astoria with the intention of attempting to pass from there, via Shoalwater bay and the Willopah river, direct to Olympia. The trail being entirely overgrown by vine maple, it was impossible for him to get through at that season of the year with the provisions he was obliged to carry; it became necessary for him to turn back before he reached the head of the Willopah. His report on the subject will give the detailed information he obtained with regard to that section of the country. I will merely state that the valley of the Willopah is about thirty miles long, by some ten or twelve in breadth; it is thickly overgrown with vine maple, and occasional large trees; the soil is rich, though somewhat light. On the Chehalis are a number of prairies, many of good soil, especially on the south fork. The whole country is, with the exception of these prairies, densely overgrown with fir, cedar, and spruce. There are many mountain ridges, some of which are quite extensive. The south fork of the Chehalis and Gray's river head in a quite high peak.

In my railroad report of February 8th, I gave my reasons for considering Seattle as the best terminus for a railway on the eastern shore of the sound. In any future examinations it would be advantageous to examine a line leading to Port Discovery. The advantages of that harbor, both as to its situation and its facilities for perfect defence, by permanent works, entitle it to consideration. It seems to be fully adapted to the purpose of a great naval establishment.

The country through which we passed to the east of the Cascade range may be described as generally barren and unfit for agriculture, and poor for grazing purposes. There are two small tracts which are exceptions to this rule; but I know of none which would be considered good in our western States. The yellow pine on the slopes of the mountains may be carried down the principal streams into the Columbia, and thence rafted or "run" to the head of navigation; the larch, between the Okinakane and Colville, can be hauled to the streams of the same names, and rafted to the Columbia; the building-stones in the vicinity of the Pisquouse will some day be available for the market; but labor must become more cheap and abundant, capital more plenty, before these can become important interests. The Indians are harmless and peaceable; with the exception of the Yakimas, they are very poor. Their food consists of salmon, berries, and potatoes. The entire absence of game renders it difficult for them to obtain good clothing; during the whole trip I did not see a single deer, elk, or bear—nothing larger than a wolf. Wolves, badgers, squirrels, and a few gray marmots, were the only quadrupeds. The blue and ruffled grouse, prairie chicken, and sage-fowl, abounded. To the west of the mountains the country is covered with dense fir timber, interspersed with prairies or lakes. The only good land I have seen is in the valleys of the Columbia and Cowlitz, and of some of that string of prairies which skirt the mountains from the Columbia at least as far as the Skywhamish. The Willopah and Chehalis have also good land upon them. The prairies near the sound are uniformly of gravel, barren and worthless. Lumber and the fisheries must constitute the great interests of this portion of the Territory.

The Indian names of these streams, lakes, prairies, &c., were carefully obtained by Mr. Gibbs during the trip. They have been adopted in the map and the reports as preferable to any names we could give them; partly for the purpose of endeavoring to perpetuate them, and partly for the reason that they will be of service to persons travelling through the country.

During the exploration the astronomical observations were principally taken by Lieutenant Duncan; they are as accurate as the instruments at our disposal would permit. The only astronomical phenomenon worthy of note was the existence of a comet, seen from Wenass, on the 21st, 22d, and 23d of August. It was visible but for a short time after dark, and was so low that the altitude could not be taken. The tail was 53′ 10″ in length. At 8*h*. 56*m*. 59*s*. (mean time) on the 21st, its bearing by compass was north 75° west, the variation of the needle being 17° 30′; its observed distance from Ursæ Majores at 9*h*. 6*m*. 6.7*s*. (mean time) was 67° 54′ 35″. On the 22d its bearing by compass at 8*h*. 3*m*. 09.5*s*. (mean time) was north 84° west, variation of the needle as before; its distance from Jupiter at 8*h*. 13*m*. 17*s*. was 9° 41′ 35″; from Arcturus at 8*h*. 18*m*. 25.9*s*., was 36° 29′ 05″.

For geographical purposes but little additional information is needed concerning the eastern slope of the mountains. A somewhat closer examination of the Pisquouse, Chelan and Millekitekwu, as well as astronomical observations with better instruments than were at my disposal, would be interesting. With regard to the western slope, much additional information is still desirable as to the courses of the streams, of which but little is known. The accompanying map will be found more accurate than any which has preceded it. It is believed that no important stream on the western slope is omitted; when none of the party have crossed or followed them, they are given from the best Indian and other information. From Bellingham bay and the vicinity of MacDonough's island we saw the direction of many of these valleys, and learned where they headed, with reference to streams on the eastern slope, the number and position of the branches, &c.; the streams as given will be found, I think, not to differ very materially from the truth. The map will, at least, serve as a basis of operations for any future survey. In the event of any detailed examination of the country in the future, the work should be performed by several very small parties, each the smallest in number that can use the necessary instruments. On the eastern side they should be provided with good mules, but do most of the mountain work on foot. The only supplies to be had in the country are salmon, berries, and potatoes. There is no danger to be apprehended from the Indians, however small the party may be. On the western side the exploration should be made by ascending the rivers in canoes, examining the country at the heads of and between the streams on foot. Some little game may be depended upon on this side. More caution will here be required among the northern Indians, although a small party may safely go among them. An examination of the Olympus range, and the lower Chehalis, would also be very desirable to develop the resources of the country, as well as for geographical information. That survey also should be made in canoes and on foot; rather larger parties would here be necessary—about ten men in each. In submitting the accompanying sub-reports, mentioned in the beginning of this, I would state that they are necessary to a full understanding of my own. I have endeavored to avoid all unnecessary detail, leaving to those gentlemen the full explanation of their respective provinces. I am glad to state that they have done such full justice to their subjects that no word of commendation from me is necessary; their reports are of more interest than my own, and can safely be left to stand the test of their own merits. I cannot, however, be equally silent with regard to their conduct while associated with me in the field. Their duty was not only performed with intelligence, but with alacrity and cheerfulness. Lieutenant Duncan possesses the qualities to conduct any expedition like this. Lieutenant Hodges was an energetic and systematic quartermaster; he conducted his difficult march to Steilacoom in the most satisfactory manner. Lieutenant Mowry performed his duty excellently, and left nothing of it, that I desired, undone. I have no hesitation in saying that no one could have been found who could have made so complete and excellent a report upon Indian matters as that of Mr. Gibbs. His report upon the geology will show the care with which he pursued this portion of his duty; in addition to this, he has more than once conducted important reconnaissances with great benefit to the survey. The courses and distances, so important to the correctness of the map, and so difficult to be obtained in the country we traversed, were taken by Mr. Minter with a care and judgment that left nothing to be desired; on other points, also, his good judgment was of great assistance.

Dr. Cooper was unfortunate in having a field so destitute of animated beings as was the scene of our operations; but, such as it was, he used it to the best advantage. We were fortunate in having but few cases of sickness. In those that did occur, the Doctor showed himself to be perfectly familiar with his profession. The non-commissioned officers and men composing the escort uniformly conducted themselves in a manner to do credit to themselves and to their regiment. It was with great regret that I parted with them at Wenass.

The civil employés were almost all very excellent men, who understood and performed their duty well. When we were fairly started, there was no trouble among them. As to those retained upon the reduction of the party, there was scarcely one who was not all that could be desired in his position. Had I the same duty to perform again, but few alterations would be made in the party, so well and cheerfully did they do all that was required. I must express my appreciation of their excellent and subordinate conduct, and of my good fortune in having so excellent a party.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieutenant of Engineers, and Brevet Captain, U. S. A.,
Commanding Western Division of Survey.

Governor I. I. Stevens,
Chief of Northern Pacific Railroad Exploration and Survey.

WASHINGTON, D. C., *May* 9, 1853.

SIR: On your arrival at San Francisco, you will ascertain from the proper sources the exact state of affairs with reference to the supplies and personnel of your command. Before leaving there for the Columbia river, you will make all the arrangements necessary to carry out the general instructions for the conduct of the expedition.

Having arrived at Astoria, you will at once proceed to organize your command at such point, either in Oregon or Washington Territory, as you may decide to be the best. You will employ such guides, hunters, and mulcteers as you may find necessary, as well as the civil assistants indispensable to the performance of the required duties. With regard to these, and all other points involving expenditure, you will be careful to observe the strictest economy compatible with the success of the expedition. The first and most important point to which your attention is to be directed will be the exploration of the Cascade mountains. You will thoroughly explore this range from the Columbia river to the forty-ninth parallel of north latitude, making detailed examinations of the passes, and obtaining full information in relation to the range in general. Pending this examination you will endeavor to examine the line of the proposed road from Wallah-Wallah to Steilacoom, and to start its construction. Having completed the survey of the Cascade range, you will at once proceed eastward as far as the Rocky mountains, unless you meet, before reaching that range, the main party coming from the east. In selecting your route, you will start from the most practicable pass in the Cascade range, and follow what you regard as the most promising line for a practicable road. From the nature of the case it is impossible for me to give you detailed instructions; but I have, in the course of a number of conversations, fully explained to you the objects of the expedition, my own probable operations, and my views.

I have, therefore, to direct you to keep constantly in your mind the tenor of these conversations, and the written general instructions. You will use your own judgment as to the manner of carrying them out in the most rapid and effectual manner.

Whenever you meet with the main party from the east, or any portion of it, you will at once assume the command, (in my absence,) and give whatever orders may be necessary, in your opinion, to carry out the objects of the expedition. Funds will be placed at your disposal to meet your expenses.

Enclosed are the general and detailed instructions of the expedition, with an explanatory memorandum.

Yours, &c.,

ISAAC I. STEVENS.

Brevet Capt. G. B. MCCLELLAN,
Corps of Engineers.

8. TOPOGRAPHICAL REPORT OF LIEUTENANT J. K. DUNCAN, U. S. A., TOPOGRAPHER OF THE WESTERN DIVISION.

OLYMPIA, WASHINGTON TERRITORY,
February 21, 1854.

SIR: I have the honor to submit, together with an accompanying map, the following report on the topography and general character of the country along the route pursued by the party under your command in an exploration of the Cascade mountains, during the months of July, August, September, October, and November, 1853, viz:

A route northeasterly from Fort Vancouver, on the Columbia, to the Cathlapoot'l river; thence, eastward along the banks of the Cathlapoot'l and across the ranges of the Cascade mountains, south of Mount St. Helens and Adams, to the open country beyond; thence, turning Mount Adams on the east, northerly to Ketetas, a point on the Yakima above where it receives the waters of its principal tributaries, Atahnam, Nahchess, &c., the country along the Yakima river from its sources in the mountains to its junction with the Columbia. From Ketetas northerly to the mouth of the Pisquouse or Wenatshapam; thence, up the Columbia to Fort Okinakane, the country on the Methow river from its head to its mouth, the country along the Okinakane river from its junction with the Columbia to the lakes beyond the forty-ninth parallel; thence, leaving the Okinakane at its forks, eastward across the country to the Nehoialpit river; thence, down this river to its mouth, crossing the Columbia at Fort Colville. From Fort Colville to Fort Wallah-Wallah, via the valleys of the Slawntehus, Chemakane, Cherahna, and Wallah-Wallah rivers, crossing the Spokane river a few miles below the forks or site of the old Spokane house, and the Saptin or Lewis' fork of the Columbia at the mouth of the Peluse; thence, down the south bank of the Columbia to the Dalles, and from the Dalles down the Columbia river by water to Fort Vancouver.

The country gradually rises back of Vancouver into a light range of hills running parallel to Columbia river, and generally about a mile and a half from it. Two miles from Vancouver the trail crosses a brook twenty feet wide, which empties into a lake three miles below that place; the lake communicating with the Columbia ten miles below. From this stream the country along the trail breaks into small openings or plains having no timber on them. They vary from a half to several miles in extent, are very level, as well as the adjacent country, and are separated from each other by narrow strips of woods. Kolsas, the largest of these plains, about seven miles from Vancouver, is six or seven miles long, and three or four in breadth, and connects on the south with a swampy arm of Camas plain, which stretches off to the eastward, in which direction there is a large tract of the same character of country lying along Mill creek, and running down towards the Columbia. From Kolsas the trail bears to the northeast for six miles to a plain called Simsik, about a mile and a half long. The country between Vancouver and Simsik is similar in character—heavily timbered with fir, spruce, and a dense undergrowth of maple and hazel bushes. The soil is sandy and gravelly, especially the open plains; the soil in the woods between Kolsas and Simsik is the best. The country up to Simsik is quite level; leaving Simsik east of north the country becomes hilly and broken along the trail, the hills becoming higher and more rocky as we approach the Cathlapoot'l river. Between these points the trail crosses several branches of the Cathlapoot'l. Six miles from Simsik there is a small rapid brook fifteen feet wide; two miles farther on there is another, thirty feet wide and two deep; and a third, the Yahkohtl, eight miles beyond, about forty feet wide and two and a half deep. The bottoms of these streams are rocky, and that of the Yahkohtl very stony; the currents rapid. They run among high hills, and have no valleys. They unite a short distance below the fords, the main stream uniting with the Cathlapoot'l four miles from its junction with the Columbia. Eleven and a half miles from the Yahkohtl the trail crosses the Chalacha. This river is thirty-five feet wide, ford good. It receives two branches a short distance below the ford—the first from the southeast, a bold rapid brook twenty feet wide; and the other a small rivulet coming in from the other side and running nearly parallel to the Chalacha, and one and a half or two miles from it. Thirteen miles from Simsik is Mankas Plain, surrounded by hills, and more low and swampy than the other plains met with. Six miles beyond the Yahkohtl river is the Yahkohtl Plain, a high, sandy, undulating plain, about three miles long. Five and a half miles beyond this plain occurs the Chalacha Plain, lying between the Chalacha river and the parallel rivulet before spoken of. The country between Mankas and Simsik is simply hilly; hills higher near the latter place. Between Mankas and the Yahkohtl river there are two sharp spurs of the Cascades, differing from the other hills by being higher and rocky. They stretch off to the east and west, increasing in altitude towards the east, but falling off in the opposite direction. Between the Yahkohtl and Chalacha rivers the country is high and hilly, and, in places, much broken. There is a high spur running along the left bank of the Chalacha river, and the plain of this name is entirely surrounded by high ridges and rocky peaks. An almost perfectly symmetrical peak is seen towards the northeast and at the end of the plain in that direction. Between Chalacha and the Cathlapoot'l is a high spur of the Cascade mountains, which runs along the left bank of that river. The ascent to it is gradual, and by successive hills and long slopes, but the descent is rocky and abrupt, and dangerous for loaded animals. The Cathlapoot'l is a very bold, rapid river, running about twenty-five yards in its bed, but, judging from the sand and shingle on its banks, it evidently becomes over two hundred yards wide at the ford. This, however, is not the general character of its banks, as they usually are high and well defined, preventing an overflow at any season. It is about three feet deep at the ford, and the bottom is filled with large water-worn shingle, and makes the fording difficult in so rapid a stream. Just opposite the ford the Spilyeh debouches into it from the north. Between Simsik and the Cathlapoot'l, with the exception of the small plains, the country is well timbered with fir, hemlock, &c., and the underbrush is very dense in places. Some alder and maple grow along the Yahkohtl river. The soil is generally very good. and that between Yahkohtl river and plain will compare favorably with any in the Territory; there is but little of it, however. The Cathlapoot'l, at the ford, runs nearly west and east. There are two mountain chains running along its banks, one on either side; the one on the right or northern bank is composed of rugged, broken hills, is lower than the chain on the south bank, is less continuous, and lies farther back from the river. Bluffs and spurs from it, however, run up to the river. To avoid these, the trail runs back from the river in a northerly direction across the range four and a half miles to Spilyeh plain. The Spilyeh river is crossed about a mile from the Cathlapoot'l at its forks, the trail running up the hills on the tongue between them. One branch bears to the northeast, the other to the west of north. Spilyeh plain is long and narrow. A high range of mountains border it on the north a short distance back, and on the south is seen the rugged river chain of hills that we have crossed. As this is the last of the plains which we meet on the western side of the mountains, it will be well to remark, in this place, that, from the facts noted on Lieutenant Hodges' trip across the mountains to Steilacoom, from what we saw on the route, and subsequently noticed between Vancouver and Olympia, the entire country west of the mountains is broken up by these small plains occurring at regular intervals here and there throughout its whole extent. They are generally slightly rolling and dry, and covered with fine bunch-grass. Their soil for the most part is too sandy and gravelly to be good, particularly in those which lie nearest the sound. Some of them, however, as Mankas and Chalacha, are lower and swampy, and the soil of such is better suited for agriculture. From Spilyeh the trail bears to the east, over a pretty level country, occasionally passing over spurs which come down from the chain on the left for four and a half miles, where it again strikes the river; thence follows the river for two and a half miles, and crosses to the left bank to a place called by the Indians Lakas. The northeastern branch of the Spilyeh is again crossed before reaching the Cathlapoot'l. There is a high range on the left of the trail on the right bank of the river, and the chain crossed between the Cathlapoot'l and Spilyeh plains ceases before the trail again reaches the river. The country between Spilyeh and Lakas is heavily timbered with spruce, hemlock, and fine large cedars. From Lakas the trail follows the banks of the Cathlapoot'l, crossing from side to side to avoid the bluffs running up to the river from both ranges for seventeen miles, to Wininepat. At this point the river bends from its general east and west course more to the north, and judging from the openings or gorges in the mountain ranges, (which here become high and heavy,) it soon forks, one branch running to the northeast and the other bending back to the northwest, and running up towards St. Helens. Two and a half miles from Lakas there is a fine mountain brook coming in from the north on the right bank of the river. This stream is very rapid, twenty feet wide and eighteen inches deep; bottom stony. Seven and a half miles beyond, the Noomptnamie river comes in on the same bank, from the north, almost at right-angles with the Cathlapoot'l. There is a large field of lava between the mountain brook just mentioned and the Noomptnamie river. It is limited on the north by a high rough range of mountains between the trail and Mount St. Helens, running parallel to the

Cathlapoot'l, and five or six miles back from it. There are many craters of extinct volcanoes found in this field, and wide and deep fissures, formed by the bursting of lava bubbles by cooling too suddenly. A great many large masses and small detached angular fragments of lava are scattered over the surface, and it is rough, barren, and desolate. There are traces, however, of timber (spruce) having grown on it at some time since the eruption which formed it; but fire has nearly removed them, a few charred stumps and logs only remaining. This field is narrowed towards the mouth of the Noomptnamie by the mountain chain on the north. These mountains are also basaltic in structure. The Noomptnamie is forty feet wide, and from three and a half to four feet deep—bottom rough and stony. This is one of the boldest of mountain streams, with a great fall and very rapid current. The Cathlapoot'l has also a greater fall and more rapidity of current for two miles below the mouth of the Noomptnamie. Between the Noomptnamie and Wininepat the trail passes over quite a level country; two spurs from the range on the right bank come down to the river, the one along the eastern bank of the Noomptnamie, and the other two miles beyond. The trail crosses over the first, and avoids the second by crossing to the left bank of the Cathlapoot'l, and returning to the right bank again above this spur. The chain on the south bank of the Cathlapoot'l is very high and continuous, and abrupt and broken on the water declivity, coming down to the water's edge. One mile below, where the river makes the great bend to the north at Weninepat, this range leaves the river and runs off slightly to the south of east. Another cross chain, however, runs along nearly parallel to the river, and soon runs into it. The Cathlapoot'l has no valley: cotton-wood and balm of Gilead grow in the low places along its banks. The country is well timbered with spruce and pine; between Lakas and Wininepat, with spruce, fir, pine, and cedar. The trail crosses the river Cathlapoot'l at Wininepat for the last time, and then leaves this river. The last crossings of the Cathlapoot'l are diagonal, and all its fords are difficult for animals, on account of the rapidity of the current and the immense quantities of large water-worn pebbles on the bottom. The breadth of stream is about seventy-five to eighty feet, and that of the bed, between banks, from seventy-five to one hundred yards. It cannot be forded at high water. Leaving the Cathlapoot'l, the trail bears to the southeast across the river chain, which has been running on the left bank of the river, but lying back from it at this point. This chain is not sharp or very rocky, but earthy and soft, and rounded in outline, and very high. The ascent for the first part is over five plateaux; ascent to plateaux abrupt, but not very high. The last part of this ascent is made by a long winding stretch over the side slope of the main range, and is remarkably abrupt. The descent to the Wahamis, on high rolling table-land, eight miles from the Cathlapoot'l, is gentle and gradual. Here is fine grass, worthy of note, as it is the first which occurs between Spilyeh plain and this point. These mountains have been burned over, so that their appearance is bald and barren, and the timber, where it occurs, is young growth of pine and hemlock. They are remarkable for the quantity of berries growing on them. Strawberries and four varieties of whortleberries were noted. Berries are generally found on any tract of country visited by fire, but they are mostly found in the mountains, and seem to flourish best near the summit. From Wahamis the trail bears south of east for twenty miles, to Chequoss, a point on the high mountain table-land of the chain running from the mouth of the White Salmon to Mount Adams. The immediate country is high rolling, and sometimes broken, and high ranges run off to the right and left of trail, with bald, isolated peaks occurring here and there in them. The descent from the high table-land to the Chequoss is gradual, and there are several very high peaks in the vicinity of this place. The Wahamis creek runs to the right and left of trail, generally some distance from it, and is crossed two or three times; it soon bears off to the southeast, and is one of the principal branches of the ——. Eleven and a half miles from Wahamis there are some low, wet prairies on left of trail Yawakamis, and are drained by small streams crossing the trail in basaltic ravines, and emptying into the Wahamis; there are two fine brooks between Yawakamis and Chequoss, also branches of the White Salmon. There are lakes on the table-land near Chequoss. The country between Yawakamis and Chequoss is more basaltic, and there are frequent occurrences of craters, some of which are very deep; and basaltic columns, which have yielded to time and the atmosphere, are crumbled into huge irregular masses. The lower table-lands are well timbered (where they have not been burnt over by fire) with fir, spruce, and pine; but the higher ones are too elevated for flourishing vegetation, and are only covered in patches with a few dwarf fir trees and stunted pines. The fir and hemlock are generally replaced by pine on the summits of mountains and other elevated positions, the former flourishing best and growing larger in the low countries and along the streams. The latitude of Chequoss is north 45° 56′; the longitude is west 121° 23′ 11″; variation of needle is east 16° 5′ 34″. From a high, elevated point, one mile west of Chequoss, a fine view of the Cascade mountains presents itself. From this point I was able to get a pretty accurate plan of the mountains and the general lay of the chains. From this point Mount Rainier bears north 1° west, and is about sixty-two miles distant in a direct line. Mount St. Helens bears north 46° west about forty miles off. Mount Adams bears north 40° east at the distance of twenty-four miles. Mount Hood bears south 9° 30′ east; Mount Jefferson south 45′ east. There appears to be one continuous high range running from near the Cascades of the Columbia north to St. Helens, and proceeding on to the northeast, connecting this mount with Mount Rainier. There seems to be a lower point in this connecting range just north of Mount St. Helens, as if some river, emptying into the sound, passed through it. It is not a gorge, however, and there are five distinct parallel ranges running into Mount Rainier, and lying between Chequoss and St. Helens. A second main range commences about the mouth of the White Salmon river, and runs up to Mount Adams, and continues on to the northward, connecting Adams with Rainier. A third chain commences at the mouth of the Klikatat river, a light fork of which runs up to Mount Adams on the north, and the heavier chain bears off to the north of east, and proceeds to the mouth of the Yakima. The eastern branches of the Klikatat river head in this last range.

Chequoss is on the second chain from the White Salmon river north to Mount Adams. There are several sharp needle-points to the south of Mount Rainier, and the mountains in that vicinity are very irregular and thrown together in every variety of manner. There is also a curious cathedral-shaped mountain to the south of Mount Adams, on the chain leading to Chequoss. Looking towards the south, there are four parallel ranges between Chequoss and Mount Hood; and thence, allowing one of these to be the river chain, on its southern bank, we have three ranges between Chequoss and the Columbia. The intervening country between these chains is mountainous; in some places rough and broken, in others high rolling table-land.

From Chequoss the trail bears north of east for fourteen miles to the Hoolhoolse river, descending the whole distance; abrupt descent in first two and a quarter miles, the rest of the distance being gradual. There is a small lake, a quarter of a mile long, in a lava district at the foot of the abrupt descent, and on the left of the trail. It is surrounded by a large growth of cotton-wood and poplar.

The main branch of the Klikatat river comes in from the north, and crosses the trail four miles beyond the lake. This stream is bold and rapid, thirty feet wide and two deep—fording good. This stream may at one time have been a branch of the Nikepun. As the country descends towards the Hoolhoolse, from it, and an old dry bed is frequently crossed by the trail between these points. The last five or six miles of this dry channel before reaching the Hoolhoolse is basaltic, the basalt arching the channel and making it subterranean—depth of the key of the arch from four to six feet, and bottom of channel from twenty-five to thirty feet below the surface. The arch has fallen in in places, forming natural shafts at irregular intervals, by which you are enabled to trace on the surface the course and direction of the channel underground. The Indians have a curious tradition concerning this subterranean passage. Once upon a time a great chief of the "Eliptillicum" had a wife who was changed into a mouse at his request by one of the learned medicine men of the time, as a just punishment for some misdemeanor or other that the women of those days were always committing. But the woman's soul, not profiting by the lesson of transmigration, must still work mischief under another covering; and accordingly, in a very rebellious mood, she endeavors to undermine the aforesaid chief's dominions. These caves were the result produced by her spite. With all due deference to the Eliptillicum, we may conclude, however, that its cause was volcanic eruption—the lava overrunning an existing stream, and suddenly cooling, the waters of the stream being forced into another channel.

There is a low chain of mountains stretching off from Chequoss along the right of the trail, and from two to three miles from it, and continues on towards the east. The Hoolhoolse rises in this chain.

The country is very rough and mountainous on the left of the trail, south of Mount Adams; but none of the spurs come down to it until after we have crossed the Nikepun, about four miles beyond the Hoolhoolse, where a pretty high range runs to the southeast.

From Chequoss the country is heavily timbered up to the branch of the Klikatat. From that river to the Hoolhoolse there is open pine forest, free from underbrush and covered with fine bunch-grass.

From Hoolhoolse the trail bears south of east for nine miles to Tahk plains. The Nikepun, a rapid mountain stream, is crossed three miles from the Hoolhoolse. The latter is a branch of it. The Nikepun is thirty-five feet wide, and three deep—bottom rocky. One mile beyond this river is the range running southeast from Mount Adams. Thus far the trail is over very level country, covered with open fine timber of small growth and bunch-grass—no underbrush. The remainder of the distance to Tahk plain is over this range, which is more heavily timbered; and the trail crosses two small branches of the Nikepun heading in this range. The first ascent is long and abrupt; the rest is broken and rolling. The timber on the last two miles is more open.

A range of high hills borders Tahk plain on the east, spurs of which put down to it; but the range between the Nikepun and this plain is the last which connects with the main range. On the west it is limited by high hills which come down from Mount Adams. This plain is ten miles long, and from one to three miles wide. There is a marshy lake, a mile and a half long, in it, and a branch of the Wah-wuk-chic leading from it, and running to the northeast. This plain is low and wet in many places, and gives evidence of being partially, if not entirely, under water during the wet season. From Tahk the trail bears northeast for thirty-seven miles, to the Sahpenis, a branch of the Yakima. For twelve miles the trail lies over Tahk plain and a slightly undulating country, but not hilly. A little loose lava rock is occasionally found on the surface.

Here the Wah-wuk-chic crosses the trail. The Wah-wuk-chic has no valley, and is reached by an abrupt descent. The river is about seventy feet wide at the ford, and two and a half feet deep—bottom sandy, current rapid, rough rapids just above and below crossing. A spur from the Cascades comes down along the northern side of the river, and intersects the range of hills running north and south on the east side of Tahk plain. For two miles from the Wah-wuk-chic the country is rough and broken, and ascends over two abrupt hills to a high undulating table-land beyond. The divide or highest part of this table-land is about fifteen miles from the Wah-wuk-chic, where occur some very large boulders of basalt.

From this ridge to the Sahpenis the country is more rough and broken, and an abrupt and deep ravine runs along the left of the trail, in which is a branch or fork of the Sahpenis coming in from the southwest. The other fork comes in from the northwest through a similar ravine. Two small brooks are crossed between the Wah-wuk-chic and the dividing ridge. This ridge or range runs off to the northeast, along the right of the trail. Leaving the Sahpenis at the forks, the trail runs back from the main stream and bears northeast over a basaltic broken spur, until it reaches the Sahpenis by a gradual descent seven miles beyond. There is a great deal of loose angular lava on this spur; the timber becomes more scattering and scrubby, and ceases three miles beyond the forks: this is the eastern limit of the pine timber. The Sahpenis runs on the left of the trail, gradually approaching it in a basaltic cañon with almost perpendicular sides.

The basalt in these walls is columnar. A range of high bleak hills (the continuation of the divide) is on the right of the trail, and about two miles from it. For the last five miles the country is rough, broken, barren, God-forsaken, and desolate. Off to the southeast it presents the same dreary, desolate appearance. From Wah-wuk-chic river to the forks of the Sahpenis the country is covered with open pine woods, timber large, and no underbrush; fine grass grows in the woods throughout this distance. The Sahpenis is thirty-five feet wide and two feet deep, ford good; this river has no valley at or above the ford, but the basaltic spur ceases on the left bank half a mile below, and the valley widens out into a low, sandy, gravelly plateau several miles wide.

A second stream, the Simkwee, comes into this valley from the northwest, and unites with the Sahpenis four miles below, forming the Pises river. The distance between these streams along the trail is three miles. The intermediate country is filled with arroyas, and has the appearance of being swept over in the wet season. Its soil is very sandy and gravelly; wild sage and wild rye grow upon it. A little cotton-wood and maple grow in the valley of the Simkwee, and some wide-spreading and scrubby white-oak along the banks of the Sahpenis. The Simkwee is twenty-five feet wide and eighteen inches or two feet deep; current rapid—ford good. From the crossing of the Simkwee the trail runs nearly uorth for eight miles, to the Atahnam, crossing a spur running to the east. This spur, and the one before reaching the Sahpenis, are the first of a series of radiating spurs which run off to the east from the main range of the Cascade mountains, between and separating the several branches of the Yakima. These spurs, or ranges, proceed to the eastward far beyond the trail, and fall off and lose themselves in the wide, worthless sage barrens along the Columbia river. This is a high, barren, and basaltic spur; the slope towards Simkwee and the summit being perfectly covered with sharp, angular fragments of loose, broken lava of all sizes, rendering the travelling hard upon animals. The slope towards the Atahnam is more earthy; ascent and descent abrupt. The Atahnam is a rapid stream, forty feet wide and two and a half deep. The Atahnam has a valley of one quarter to half a mile wide at the ford, but the river is very crooked, and cuts it up, by its transverse crossings, into small, worthless patches. There are columnar basaltic walls on each side of it about thirty feet high, with high, rutted, earthy, and sandy hills piled on top of them. From the ford the trail bears to the east through the valley for three miles, to the Atahnam mission. Up to this point the valley is similar to that described at the ford; but below it the basaltic walls cease as the valley widens out. Thence the trail runs nearly north for about thirty-seven miles, to Ketetas, on the Yakima, crossing the Kwiwichess, Nahchess, Wenass, and Entinum, at intervals of seven, ten, seventeen, and twenty-seven miles, respectively. Between the mission and the Kwiwichess there is a high spur almost destitute of vegetation, and covered with immense fields of small, broken lava; ascent and descent pretty abrupt, and the top or summit is a rolling, broken plateau. The Kwiwichess is a small brook, from ten to fifteen feet wide; it forks a quarter of a mile above the ford. Its valley is a sort of basin, surrounded and terminated by the mountain on the west, and about three miles from the trail, and widening towards the east until it reaches the Yakima. A little willow and aspen grow upon its banks, and there is good grass in the valley. A sharp spur of the Cascades runs between the Kwiwichess and the Nahchess. Many large masses of crumbling columnar basalt occur upon it. The trail, however, is good. The descent to the Nahchess valley is quite abrupt and rocky. Fine grass grows upon this range. The valley of the Nahchess is from two to three miles wide at the point of crossing it, but widens towards its junction with the Yakima. It is very much cut up by the crookedness of the river. Wild-cherry scrub, cotton-wood, balm of Gilead, and aspen, grow upon its banks. The river is seventy feet wide, but is one hundred yards wide at this point in the rainy season; it is three feet deep, and the bottom is filled with water-worn pebbles; current rapid, with great fall. In the hills on the north of the valley of this river is white, stratified sandstone. The country between this river and the Wenass is over a high, rolling table-land, covered with grass, and with less rock and lava upon it than on the other spurs crossed. The valley of the Wenass is a mile wide. Like the valleys of all the Yakima's branches, it widens towards its junction with that river, and narrows towards the mountains, the intermediate spurs between streams closing upon the valleys towards the main mountains, reducing them virtually to nothing. The Wenass is twenty feet wide, eighteen inches deep; bottom strong, current rapid. Wild-cherry scrub, aspen, cotton-wood, balm of Gilead, and willow of small growth, are found upon its banks. Cactus is found in this valley, and in that of the Nahchess. The country between the Wenass and Yakima is a high, barren, broken, basaltic table-land, and is mostly destitute of any kind of vegetation. Immense fields of broken lava, sharp and angular, occur upon it. The Emptenum, a small stream ten feet wide, runs through it in a deep cañon about ten miles from Wenass. The descent to and ascent from this stream are made through ravines. In the ravine or defile on the northern bank there are some very fine specimens of pentagonal basaltic columns, with convex and concave ends. The descent to the Yakima is through a similar defile. This is the highest spur crossed since doubling Mount Adams, and is highest between the Wenass and Emptenum. The Yakima cuts through this range, in a gorge, about six miles below the point at which the trail crosses this river. The Ketetas plain is a high, rolling, basin-shaped plateau, lying mostly on the northern side of the Yakima. It is surrounded by high mountains on the north and south, the northern chain being about eight miles from the river, and the southern range being the one crossed between the Emptenum and the Yakima. These chains unite fifteen miles below the ford, and terminate the plain in that direction. After uniting, they run to the east, towards the Columbia river, in a high range. To the westward the valley extends about six miles, and then ceases. The Nahnum, a bold mountain stream, comes from a gorge in the northern range nearly north of the ford, and, bending to the east, crosses the Ketetas plain and unites with the Yakima near the point where the latter river pierces the southern spur. A second stream, a rivulet four feet wide, comes from this same northern range farther to the east, and, running through the plain, unites with the Nahnum near its mouth. There is a stream also from the southwest, heading in the southern range, and empties into the Yakima by its several mouths just above and below the ford. A small strip of this plain along the river is low, and produces good grass; the other portions are either basaltic plateaux, covered with loose lava, or they are sandy, barren, sage deserts, cut up with arroyas, and unfit for cultivation.

The Yakima river has a narrow valley for about ten miles of its course on the southern bank, opposite Ketetas plain. Six miles of this narrow valley extend westward from Ketetas to the mouth of the Ptehnum, a stream on the right bank from the southwest. Above the mouth of this river there is no open valley. A pretty fair trail is found, however, on either bank, by passing over low hills and light spurs, for forty miles from Ketetas to the forks, when the Kahchess and Yahinse unite to form the main river. The pine timber commences (as you go westward) five miles above the Ptehnum, and the country is timbered thence to the forks with open pine woods, and no underbrush. Beyond the forks the timber becomes more large and heavy, and the underbrush very dense. There are high ranges on both sides of the river, a little back from it, up to the forks, beyond which the mountains become very high.

The principal branches of the Yakima on the right bank above Ketetas, are the Ptehnum (already spoken of) and the Wahnoowisha, which come in five miles below the forks. The principal northern branches are the Schwock, Yamoinse, and Samahmu, their junctions being at distances of seventeen, twenty-one, and twenty-six miles respectively above the ford at Ketetas. The Yahinse heads in Lake Kitchelus, near the Snoqualme Pass of the main range. The Kahchess river is but a short crooked stream, carrying off the waters of two large lakes. The first of these, Lake Kahchess, occurs on the river four or five miles above its mouth, and is eight miles long, and from one and a half to two miles broad; one mile above it, and connected with it by a shallow, sluggish stream, seventy feet wide, is Lake Pilwaltas. This lake is six miles long, and from one-half to one mile broad. Several mountain torrents, but no large streams, enter these lakes. They are very deep, but no exact soundings were taken for want of a line of sufficient length. There is a large lake on the Samahma river, eight miles above its junction with the Columbia. This lake, Kleallum, is seven miles long, and from one to three miles broad. The Samahma at its head is a bold mountain stream in character, and is about fifty feet wide one mile above the head of the lake. All of these lakes are embosomed in and entirely surrounded by mountains, heavily timbered with fir, pine, and cedar. The mountains around Pilwaltas particularly are very sharp and rugged granitic peaks, some of which are round and bald, and others needle-shape in structure. The Samahma river below the lake is sixty feet wide and very crooked and rapid. The Yannoinse and Schwock are streams thirty feet wide, with rapid currents and rocky bottoms. The Yakima is from eighty to one hundred feet wide, and the ford at Ketetas is shallow and good. It is usually from three to five feet deep, and fording impracticable at high water. After leaving Ketetas plain, the Yakima bends to the south until it receives the waters of the Atahnam, and then turns again to the east, and runs generally in that direction to its junction with the Columbia, about twenty miles above Wallah-Wallah. Mr. George Gibbs, who followed this river to its mouth, reports that the valley is continuous below the Atahnam, and from six to ten miles wide to within a short distance of the Columbia, where it is cut off by a range of low hills running nearly parallel to the latter. It is uniformly barren, except a few small spots along the margin, which are overflown by the freshets. The basalt continues to the Columbia. Bunch-grass grows only upon the hills, the low sandy plateau being covered with wild sage. Cotton-wood grows upon the banks as far down as the mouth of the Pisca, below which there are only a few willow bushes. The country on the Columbia at the mouth of the Yakima is a sandy desert covered with sage. The banks of the Columbia have a uniform height of about thirty feet above the river. All the country north of the Yakima, between that and the Columbia, must be more or less mountainous or high and broken table-land, as the spurs between the branches of the Yakima, coming out from the main range, unite to the east of that river along its southern bend, and run off together in a rough broken chain towards the Columbia. Leaving Ketetas on the Yakima, the trail bears to the east of north for sixteen miles to the top of the divide, and thence eighteen and a half miles to the west of north to the mouth of the Wenatsapam river. For eight miles the trail lies across Ketetas plain to the gorge from which the Nahnum comes from the mountains, and crosses the Nahnum at this point. This river is rapid and stony, and about thirty feet wide. There is a fall of three feet upon it two miles below the ford. Here we commence the ascent of the divide between the Yakima and the Columbia. The Nahnum runs for several miles from the gorge along the left of the trail in a very deep cañon, and then leaves it, bearing to the northwest. To the top of the divide the ascent is gradual except in places, and the country is rough and basaltic, with a great deal of loose broken lava upon the surface. This spur is timbered, but the trees do not extend to the east beyond one or two miles from the crossing, and then only in strips and points; timber, pine, and open for the most part. Just before reaching the divide, the trail crosses two small rivulets, the heads of the streams running through Ketetas plain to the east of the Nahnum. The top of the range, which is higher than the other spurs, is comparatively level for several miles, and has small ponds and swampy places on it. Owing to this flat, level character, the trees upon it are not seen from either the Yakima or Columbia, the range presenting a bare, barren, desolate look. From the summit a sharp angular range of snow mountains is seen off to the left of the trail, and commencing between the summit and the Columbia, run off towards the northwest. Mount Stuart is the most prominent, and is nearest the Columbia. The Samahma, Yannoinse, Schwock and Nahnum branches of the Yakima, and the Skilkantin, a branch of the Columbia, and several branches of the Wenatsapam river, head in these snow mountains. The descent from the spurs is by plateaux—that of the first four being abrupt and rocky. The pine timber ceases about four miles before reaching the Columbia. The Skilkantin, a stream twenty feet wide, rapid and stony, is crossed two miles above its mouth, and the trail crosses two of its small branches in the descent from the divide. Follow this stream from the ford to the Columbia, and then turn up the banks of that river. The range we have just crossed runs along the river below the point at which we struck it, and bluff up to the water. Above this point the range keeps back from the river on the left of the trail, and strikes the Wenatsapam two miles above its mouth. Between the range and the river there is a low sandy plateau, covered with sage and immense masses of gneiss rock and granite boulders. There is also some sandstone at the point where the trail turns up the Columbia. This sandstone is soft, and has been worked, by the action of the water and the atmosphere, into curious and fantastic shapes.

Two pillars of this rock stand side by side, out upon the plateau, between the range and the river, and are peculiar from their forms, isolated position, and the curious water-worn holes through their tops. The Indians, as usual, have some tradition about them concerning somebody's clouchman, but it simply resolves itself into the old story of Lot's wife and the pillar of salt. I wonder, after all, if the old patriarchs, in their nomadic days, were anything better than the Indians of the present time, and if the story of Lot and his inquisitive wife did not come down before the time of Cadmus, much after the fashion of the humble tradition of these poor savages about two lone sand pillars on a desert. The country on the opposite side of the Columbia presents a very desolate and barren look. It is a high, broken plateau, covered with fields of broken lava for miles in extent, which give the country the black, barren appearance of having been burnt over by fire. There is a higher bluff on this same side of the river opposite the mouth of the Wenatsapam, which runs off to the northeast in a rough, barren chain. A chain on the right bank of the river commences in a similar bluff, a mile and a half from the river, and nearly the same distance above the Wenatsapam, and, running along the Columbia, closes in on this river about five or six miles above. The country between this range and the river is a low plateau, sandy and barren, covered with wild sage. The Wenatsapam has no valley, and runs among the hills towards the main mountains on the west. This river is about seventy-five feet wide and three feet deep; ford good. A little cotton-wood grows upon its immediate banks. The trail follows up the right bank of the Columbia, from Wenatsapam, for sixty miles, to Fort Okinakane, crossing the En-te-at-kwu, Che-lum, Methow, and Okinakane rivers, all branches of the Columbia. The country along the trail throughout this distance is similar in character. The river has no valley; the bluffs or river ranges on both banks coming down close to it, so that the trail is constantly crossing high plateaux, or passing over sharp bluffs running down to the water's edge. Some of these bluffs are rough and stony, and very dangerous to pass, with immense granite precipices several hundred feet high overhanging the trail. The most difficult of these passages are found along the river for a distance of six or seven miles after crossing the En-te-at-kwu river. There are low plateaux, narrow and wedge-shaped, generally found at the junction of all the larger streams, lying between these streams—the river range and the Columbia. At such places the range lies back a short distance from the river, but soon closing on it again. There is little or no timber along the Columbia—a few straggling pines, or patches of them, only occurring at intervals here and there. The left or opposite bank of the river is in every way similar. It is possible that timber grows upon the high table-land on top of the ridge on the right bank of the river, but it cannot be seen from below, except occasionally through gorges. The Columbia is generally from 300 to 500 yards wide, apparently very deep, and the current is usually very rapid, and in some places rough. The rise in the wet seasons is about twenty feet, judging from the high-water mark on the banks and on the trees. These small runs or spring branches empty into the Columbia about six miles above Wenatsapam, and the En-te-at-kwu comes in about six miles above them. One of the low plateaux spoken of is found at the mouth of this river after crossing it. It is entirely made up of gravel and water-worn shingle, and covered with granite boulders; it is barren, and on its upper end is a patch of scrubby pines. The En-te-at-kwu is very rapid, bottom rough and filled with water-worn stones. It is thirty-five feet wide and two feet deep. The spurs coming in very close to the river above the En-te-at-kwu, it is found necessary to avoid them about eight miles above that river, passing around them on the high land above. In the wet season it is necessary to turn off even before reaching this point, as the trail passes for the last two miles just along the water's edge. The trail passes up to the high land through a gorge formed by a small mountain brook, and again comes back to the river about thirteen miles above. Two other small spring branches enter the Columbia about two miles below this point. The mouth of the Chelan is ten miles above it. The country on the top of the range is rough and broken, and the river chain is intersected by several cross chains running nearly east and west. There is pine and fir on the top of this table-land, and there is no indication of it on the left or eastern bank, except a few scattering trees on the margin of the river; we may take the Columbia as the eastern limit of timber along this part of its course. Five miles after leaving the river the trail strikes the edge of Chelan lake, and, following it for several miles, crosses the Chelan river at the point where the lake debouches into it. The river is seventy feet wide and three feet deep; its length to the Columbia is about three miles; it becomes a perfect torrent, and is very crooked. About eight miles of the lake is seen lying nearly east and west. Beyond that it turns more to the northwest, and is hidden behind the mountains. From the Indian information received, this lake must be thirty-three or thirty-four miles long, and heads in the main chain of the Cascades near the headwaters of the Methow. This lake is over a mile wide. The mouth of the Methow is seventeen miles above that of the Chelan. Between these streams the mountains do not come so bluff up to the river as they have done, but on the left bank they come down to the very water's edge, but are not so high as they have been. The intermediate country is a low, sandy, barren plateau, rocky and stony in places, and covered with large water-worn boulders for two miles before reaching the Methow. This river is sixty feet wide and two and a half feet deep; current rapid. It heads in the main Cascades, and forks miles above its mouth; one fork, the main Methow, coming in from the northwest, and the Twitsp from the southwest. There are mountains or high broken table-lands on both of its banks throughout its whole extent. It has a narrow valley in places, but the river is so crooked that these valleys are so much cut up as to be unfit for any purpose whatever, even for a mule trail. This river is remarkable for the terraces on its banks and on the slopes of the mountains which border it. In some places as many as eighteen successive ones are visible. These terraces are also found on the Wenatsapam and the Okinakane, and similar ones occur on the Columbia between the mouths of the latter streams. These facts, taken in connexion with that of the large water-worn boulders, and immense drifts of sand and shingle on the low plateaux, at the mouths of the Wenatsapam, En-te-at-kwu, Methow, and Okinakane rivers, and the character of Lake Chelan, and the lakes of the Okinakane river at the present time, lead me to suppose that at one time all these rivers were long narrow lakes, which have since broken their barriers gradually, only by some violent sudden action, and their waters drained off by the Columbia; and, also, that a lake may have existed even in the present locality of the Columbia itself, this river running at the time through the region known as the "Grande Coulée." Between the Methow and the Okinakane the river range on the right bank runs back for some distance from the river, leaving a series of low, sandy, barren plateaux, widest towards the Okinakane; they are covered with wild sage. On the opposite bank the range is bluff up to the river, and obstructs the view of the country beyond, so that its character cannot be determined. The plateaux on the right bank are intersected by ravines, or deep arroyas. A stream comes in two and a half miles above the Methow, and high mountains run along it, increasing in height from the Columbia. A trail was run between the mouth of the Okinakane and the forks of the Methow in a direct line. The country is high, rolling and broken, and terraced near the Columbia. This trail crosses the small stream which comes in above the Methow. Beyond it to the forks the country is well timbered. There are rough, broken rapids in the Columbia, at the mouth of the Methow—"Ross Rapids." There is a terraced sandy plateau, wedge-shaped, between the Okinakane and Columbia. It is three miles wide and seven miles long. A low range of basaltic hills limits it on the east, and runs nearly north, until it ends in an abrupt bluff on the Okinakane. The other sides are limited by the Okinakane and Columbia rivers. The soil is almost worthless. A long strip of plateau, similar in character, is found on the right bank of the Okinakane. Fort Okinakane is on the tongue between the Columbia and Okinakane rivers, near the former, and two miles from the mouth of the latter. The site of Astor's old fort is very near the junction of these two streams. Thence the trail follows up the banks of the Okinakane, crossing from one bank to the other, for eighty-seven miles, to the lakes beyond the forty-ninth parallel. For three miles the trail is over the low, sandy plateau spoken of, and then crosses to the left, to avoid the bluffs. After fording the river, the trail runs back over the high ground, and returns to it again thirteen miles beyond. There is a salt lake on each side of the trail, three miles above the ford; the largest, three-quarters or one mile long, being on the left. A carbonate, or some similar salt of soda, is found as impalpable powder on the shores of these lakes. From the river to these lakes the country is rough and basaltic, and a great deal of loose, broken lava is on the surface. A high ridge or chain runs nearly east and west, just beyond the lakes, intersecting the river at right angles. The trail crosses this range, the ascent being gradual through the gorge of a small stream entering the larger lake; and the descent is over successive terraces, the last descent being abrupt and stony. There is a small salt lake on the north of the top of the divide, from which the water runs into the Okinakane. Aspen grows on this lake, and cotton-wood on the small streams leading from it, and a few scattering pines are on the ridge. The Okinakane throughout its length has no continuous valley. Low ranges of bald, barren mountains coast it, but not continuously; sometimes running close to the water's edge, at others lying back from the river and sending out spurs to it. These sometimes are terraced like those on the Methow, but not to the same degree. By running into the river and out from it, these river ranges form plateau valleys, varying from a simple gorge to one or two miles in width. The Okinakane receives four branches from the west, between the mouth and the forks. The largest of these branches is the Nistepehtsam, twenty miles above the mouth of the river, and it is twenty feet wide and eighteen inches deep; they are all fine, rapid mountain brooks. There is a fine fall in the Okinakane river thirty-three miles above its mouth. These falls are horse-shoe shaped, the convexity being up stream; fall of water five feet. The trail crosses to the left bank five miles above the falls, and three streams come in on this side, at distances of one, two, and four and a half miles, respectively, above the ford. These streams have all rapid currents, and are from fifteen to twenty feet wide. The country is very gravelly, and the soil poor, between the ford and the forks, ten miles above it. There is more timber along this portion of the river than heretofore, cotton-wood, &c., and a few scattering pines. The main stream, Sahtlilkwu, runs nearly north above the forks; the other fork, the Millakitekwa, bearing to the northwest. On the latter river there is a fall of ten feet about four miles above the junction. The trail follows up the right bank of the Sahtlilkwu, along which the country has much the same character as before. The mountains, however, become higher, and have a growth of open pine upon them. There are four large lakes on this river above the forks. The first, the Osoyoos, commences one mile above the forks, and is ten miles long, and over a mile wide; the second is five and a half miles long; the third is eight miles long. These lakes are very deep; but two sand-bars project from about the middle of Osoyoos from either bank, and a fording is practicable at this point. The trail goes up as far as Lake Okinakane, thirty-seven miles above the forks. This is the largest and longest of these lakes, and stretches off to the northward into British territory for many miles. The country up to this lake is as heretofore, the soil very sandy and gravelly. Three small streams come into Lake Osoyoos on its eastern side. Leaving Lake Osoyoos, the trail passes up through the gorge of one of these streams, coming in near the lower end of the lake, and bears eastward to the Siyakan, a branch of the Nehoialpitkwu river, and follows down this stream to its mouth. Thence the trail keeps down the banks of the Nehoialpitkwu (crossing from bank to bank, as necessity requires, to avoid the high bluff spurs) to its junction with the Columbia, two miles above Fort Colville. The distance to Fort Colville from the lake is about eighty-two miles by the trail, and it is about twenty-two miles to the mouth of the Siyahkan. A large fork (probably the main stream) comes in from the north thirty-one miles above the mouth. There are eleven small branches of the Nehoialpitkwu from the north, rapid mountain brooks from fifteen to twenty-five feet wide, and seven of similar character from the south, including the Siyahkan. The ascent to table-land from the lake is only abrupt in places, and is for the most part a long and gentle slope. The mountain divide is high terraced to its top, summit undulating and broken in places, with wet, marshy places, and small spring ponds, interspersed over it, in which the streams rise. The descent to the valleys of the Siyahkan and Nehoialpitkwu is gradual, except the last intermediate descents to these streams. The summit is well timbered with larch and pine, and some aspen and maple grow in the wet places. Fine bunch-grass grows uniformly over this range; it is soft and rounded in outline. Looking back from the summit to the Cascade mountains beyond the Okinakane, they present a series of parallel ranges running nearly north and south. These ranges appear to increase in altitude towards the main range, and to become more broken and harsh in outline. They were covered with snow at this date—October 13th. The valley of the Nehoialpitkwu is similar to those of the Methow and the Okinakane. The mountains along it are heavier and higher than on these latter streams, and heavily timbered with larch, pine, fir, and cedar. A little cotton-wood grows here and there on the margin of the stream. The mountains are continuous in high heavy masses at intervals, and then again run back from the river and fall away towards it in isolated hills and low, sharp, broken spurs. The trail crosses from side to side of the river as the spurs and bluffs require it. There is a low table-land, over which are scattered a great many small ponds, on the left bank of the river, five or six miles from its mouth. The Columbia was crossed opposite to Fort Colville. It is about three hundred and fifty yards wide at this point, and the river is very rapid. The Soinetkwu or Kettle falls are one mile below the crossing. These falls are about ten feet high at the lower falls, and about fifteen feet high at the upper falls, and the river is narrowed to about two hundred yards. The river here runs nearly north and south. The Slawntehus empties into the Columbia from the southeast at the falls. There is a long, narrow, sandy plateau at Fort Colville. A low range of mountains bound it on the east, lying back from the river. The chain comes bluff up to the river again below the mouth of the Slawntehus. The soil of this plateau is sandy and gravelly; fine grass grows upon parts of it. From Fort Colville the trail bears to the southeast for fifty-eight miles to the Spokane river, following up the valley of the Slawntehus and down the valley of the Chemakane. Low ranges of mountains are on both sides of the Slawntehus near Colville, but they gradually fall off in altitude as they proceed to the south, and break up into irregular hills at or beyond the Spokane river. These ranges are timbered with larch and pine. A fine valley lies along the Slawntehus for thirty-five miles, varying in width from one to three miles. The soil of this valley is generally good, and capable of producing any of the crops that will grow in this latitude. It is boggy and marshy in places, and a great deal of it must be under water in the wet season. Much of it can be reclaimed by draining. Several settlements are made in the valley of this river. This river differs in its character from those on the right bank of the Columbia river. Its banks are low and subject to overflow; it has a valley; and the current is more sluggish. It is very crooked; thirty-five feet wide, and from six to ten feet deep. The fords are from three to three and a half feet deep, and bottom gravelly. The Slawntehus heads in a low range of mountains running northwest and southeast about forty miles from Colville. It has four eastern branches, the Schlowskan and Kitsemmawhep being the largest of these branches. The trail up to the divide in which this river rises is very good, and is for the most part through the valley over level county. The divide is timbered. Crossing the divide, (in which the Chemakane also rises,) the trail keeps down the valley of this latter river to the Spokane. This valley terminates about five miles above the junction of the river with the Spokane, and the soil for a mile at this lower end is good for farming: the other portions of it have a light gravelly soil; good grass grows upon it. The old Presbyterian mission was situated at the lower end of this valley. The valley varies from one to two miles in width, and is skirted by low ranges of hills well covered with pine. From the mission the trail runs over a low hilly country, covered with open pine woods, to the Spokane river, leaving the Chemakane on the right. The descent to and ascent from the Spokane river is abrupt and rocky. There is a tolerably good diagonal ford at this point—bottom gravelly and somewhat stony. This river is about seventy-five feet wide and three deep, current rapid. A very precipitous, high, rocky bluff is on the left bank, half a mile below the ford. All the country between the Slawntehus and Chemakane, westward towards the Columbia river, is more or less mountainous or broken by irregular ranges. These mountains are higher towards the north, and break up and fall off towards the south into low ranges and undulating plains in the great Spokane plateau. The trail bears to the southwest from the Spokane river across this plateau—crossing the Saptin or Lewis fork of the Columbia at the mouth of the Peluse. This distance is seventy-six miles. There is no timber on this plain, except a few narrow strips of pine wood, which stretch out to the westward from the Cœur d'Alene mountains on the east. These strips proceed to the westward no farther than the trail, and are confined to the country twenty-two miles from the Spokane river. A little willow and cotton-wood are also found on the immediate banks of the streams, but in small patches. A district of country about twenty-four miles wide commences twelve miles south of the Spokane river, and runs east and west nearly, which is the highest portion of the Spokane plateau. This district is basaltic and broken, and is covered with innumerable small lakes scattered over its surface. These lakes appear to occupy the craters of extinct volcanoes, and are fissures formed by the bursting of lava bubbles on cooling. The water in them is fresh, and supplies the Peluse and its branches. These lakes are of all sizes; Silkatkwu is the largest in the vicinity of the trail. It is five miles long, and varies from one-half to a mile in width. It is drained by the Stkahp, a branch of the Peluse. The main Peluse also rises in this region of lakes, to the east of the trail. I have no actual observations of the extent of this lake country to the east and west, but presume that to the westward, particularly, it must run for many miles; at least, up to what is known as the "Grande Coulée," and, perhaps, over to even the great western bend of the Columbia itself. The Spokane plateau embraces all the country included within the limits of the Cœur d'Alene mountains, the Saptin, Columbia, and Spokane rivers. It has an undulating stratum of basalt, which is covered with deposits of earth, sand, and gravel. The basalt occasionally crops out, particularly on the lake region and along the streams; and large irregular masses, pillars, and architectural shapes are scattered over this region. The country in such places is rough and broken, and covered with large and small fragments of sharp fractured lava. The earth, sand, and gravel form rounded undulating chains, or isolated hills or buttes, covered with wild sage and grass, the grass being found on the least sandy portions. The plateau generally is high and rolling, and destitute of timber. The soil is light and unfit for cultivation. Small tracts of arable land are found near the larger lakes and the heads of the streams, but they do not exceed one or two acres in extent. The Cherahna runs in a basaltic dalle or trough for most of its length; the last part of it, before its junction with the Peluse, being in a cañon of columnar basalt. The Peluse, from the point at which we crossed it, runs in a similar deep cañon. The walls of the trough of the Cherahna are not more than twenty feet high. A few stunted willow bushes grow in these cañons on the immediate banks of the streams. The basaltic walls and hills along the Peluse increase in altitude towards the Saptin. The Saptin, at the crossing, is about one hundred and fifty yards wide, very deep, rough and rapid. This river, at this point, has no valley, high hills running on either side of it. The Peluse is first crossed quarter of a mile below the mouth of the Cherahna, and the trail then passes over the hills, leaving the river some distance on the right, and comes down to it again three and a half miles from its mouth. Between the trail and the river, on the right, the country is much broken and very rough, with a good deal of lava on the surface.

To the left the country is hilly and sandy, not so much broken, and has but little loose lava on the surface. The descent from the high table-land to the Peluse is over successive plateaux, and gradual, the final descent being very abrupt and long. Leaving the Saptin, the trail passes over the range between this river and the Touchet, bearing to the west of south; thence in same direction for nineteen miles to the old Presbyterian mission, on the Wallah-Wallah river, twenty miles above its mouth. There is one main range between the Saptin and Touchet, made up of high, rolling, earthy hills, on underlying basalt. These hills are much rutted and gullied by the action of water, and very soft and rounded in outline. They are covered with fine bunch-grass, and are destitute of timber. The ascent and descent are gradual, the trail passing up and down the ravines between the slopes of the hills. The Touchet has a fine grazing valley at this point, and some small portions of it are good for farming. This valley is from one to two miles wide; a fine growth of cotton-wood, and some wild-cherry and maple, grow along the margins of the river. The Touchet is thirty feet wide and two feet deep; ford good. A high bluff range commences on the left bank half a mile below the ford, and the northern side of the valley is bounded by a high range of soft hills, the continuation of the spur crossed over. There is much the same character of country between the Touchet and the mission on the Wallah-Wallah, the hills having a greater tendency to single isolated hills, than to continuous ranges. The Wallah-Wallah has a fine valley at the mission several miles wide. The valley is intersected and cut up by a net-work of streams, all of which unite some miles above, and the main stream comes from the mountain range on the east. A second large branch (probably the main stream) comes in at the mission from the south, from the same mountain range. This range follows the Wallah-Wallah river down to its mouth, and unites with the Basaltic river range on the Columbia. It becomes basaltic near the latter river. A dry bed, with cotton-wood along its banks, runs along the left of the trail as you come from the Touchet, and crosses it five miles from the mission; thence running off to the right, it comes into the Wallah-Wallah river six and a half miles below the mission. From the mission to its mouth, there is a fine valley along the Wallah-Wallah, some portions of which are arable and capable of cultivation. This valley is limited by a range of hills on the north, which close into the river at the mouth of the dry bed. Fine growth of cotton-wood flourishes on the banks of the Wallah-Wallah at this portion of the stream. All the country from the mission back to the Saptin is covered with a luxuriant growth of bunch-grass; and the valleys of the Touchet and Wallah-Wallah (at the mission) present more favorable advantages for grazing ranches, in the way of grass, timber, water, nearness to settlements, and mildness of climate, than almost any other portions of the Territory. The Wallah-Wallah makes a bend to the south at the point where the dry bed comes in, and the trail runs over the hills, keeping the river on the left. The trail comes down to the river again six and a half miles above its mouth, and then follows down the narrow strip of valley along this part of the river, and frequently crosses, to avoid spurs coming in from the right and left. The hills get higher to the north, a low range of sand-hills skirting the river on this side, and becoming very rocky and basaltic near where the trail comes down to the river. The trail crosses the Touchet, three-quarters of a mile above its mouth, while making the bend over the hills away from the Wallah-Wallah. All the country in the vicinity of Wallah-Wallah, and back along the river to where the dry bed comes in, is very sterile, sandy, and barren, and the sand is light and drifting. Nothing but wild sage grows upon it. There are only a few clumps of willow bushes along the river throughout this distance. From information received from Hudson's Bay people at the fort, this same sandy character of country is found up the left bank of the Columbia to the Saptin. The Wallah-Wallah river is about fifty feet wide, two feet deep, bottom fine and gravelly. Leaving Fort Wallah-Wallah, the trail follows down the left southern bank of the Columbia, crossing the Umatilla, the Hokespam, Nahhah or John Day's, and the Wanwawwie or Des Chutes rivers, near their junctions. The Columbia along this section is rapid, and sometimes rough, and it is filled with numerous sand islands and basaltic rocks. It is about five hundred or six hundred yards in width, and has no valley. The high basaltic terraced range of hills which has been following the Wallah-Wallah for some distance above its mouth, turns down the Columbia at this point, and follows it to the Dalles in an almost uninterrupted chain. This chain varies in height, and is only broken for a short distance between the Umatilla and Hokespam. A similar terraced chain commences in an abrupt bluff on the northern bank, two miles above Wallah-Wallah, and continues uninterruptedly to the Umatilla, opposite the mouth of which it suddenly terminates in an abrupt bluff. From this bluff a high chain runs off from the river range to the northeast. The river chain soon commences again on this side of the river, and then is continuous to the Dalles, and increases in altitude in that direction, and runs bluff up to the river throughout. There is no timber along the Columbia, or on its branches, except a few clumps of willow scrub, and but little grass. The basalt ceases about a mile above the Umatilla, and commences again one and a half mile above the mouth of the Hokespam, below which the river-chain is high and continuous. The trail finds its way over high terraces, the side-slopes of the river ranges, and over the low plateaus, frequently crossing over rocky spurs running down to the water's edge. Above the Umatilla, and between the Wanwawwie and the Dalles, it leaves the river altogether, and passes back over the hills on the left to avoid the rocky and more difficult places along the river. This high table-land above the Umatilla is very sandy and barren, and produces nothing but stunted wild sage bushes. The sand is light and drifting. Between this river and the Hokespam the country rises gradually back; a light line of sand-hills runs parallel to the river about a mile back, and this country is very sterile, sandy, and barren. The Umatilla is fifty feet wide and two feet deep, bottom sandy, and ford good. The Hokespam is twenty-five feet wide and eighteen inches deep, with a stony bottom. The Mahhah is sixty feet wide, two and a half feet deep, gravelly bottom, and fine, good crossing. The Wanwawwie is not fordable; it is thirty yards wide, and very rough and rapid. The Hokespam has a very narrow valley. Between the Wanwawwie and the Dalles, the trail passes back from the river and crosses two ranges—one between the Wanwawwie and the Waiyum, and the second between this stream and the Columbia at the Dalles. The trail crosses the Waiyum nine and a half miles from the Dalles; the river then runs towards the Columbia for one mile, and then turns down parallel to it and empties above Fort Dalles. It receives a branch from the southeast, a few miles above Fort Dalles. This country is high, rolling table-land, covered with good bunch-grass. At the Dalles, the Columbia makes a bend like a horse-shoe towards the south, and the river runs through a basaltic trough. Walls of trough about twenty feet high; river 200 yards wide; rapid current, but not rough. The river chain on the northern side continues westward, without following this bend in the river; thus leaving a few miles of comparatively level country, but very rough and broken, and rocky. There is a low valley, four miles long and one mile wide, along this bend on the southern side, but it overflows at high water. Besides the Waiyum, a second small stream enters the Columbia at the bend, from the southwest. A third comes into it from the northern side. The distance from the Dalles to Fort Vancouver was made by water. The river is generally rapid. At the Cascades it is too rocky, rough and rapid to be navigated; a short portage, therefore, is necessary, and a railroad has been constructed for the purpose on the northern bank. The mountains between the Dalles and the Cascades are timbered, in some places heavily so, and become higher and rougher. Below the Cascades the river-range falls off into low spurs and hills, which terminate a short distance below Cape Horn. The country thence is level on both sides of the river to Vancouver, and is heavily timbered. The highest mountains along the river are at the Cascades, and at the mouths of the White Salmon and Klikatat rivers. These points, therefore, are the points on the Columbia from which spring the main Cascade ranges, which run to the north up to Mount St. Helens and Mount Adams, and centre in Mount Rainier. Thence one main chain connects with Mount Baker, and another runs off to the northeast. These principal chains throw out innumerable spurs; the western one filling up with high mountain table-land, and low hilly ranges most of the country on the north, up to the very shores of the sound, and on the south covering, in a similar manner, all the country limited on the west by a broken line drawn from the sound to a point on the Columbia a few miles below Cape Horn. The eastern range, as we have seen, throws out high spurs between the Yakima and its branches, covering all the country north of this river up to the Columbia. As there is another high range running northeast from the mouth of the Klikatat, and only terminating with the Columbia after coursing the Yakima, from six to ten miles to the south of it, we may safely infer that most of the country between it and the northern river-range of the Columbia is either mountainous or high, broken table-land. The country east of the Okinakane river, and north of the Columbia, having been found mountainous, the Columbia river may be taken generally as the eastern limit of the mountains, or of high mountainous country. The main range, and all the territory west of the range, are heavily timbered with pine, fir, larch and cedar. The eastern limit of timber is the Columbia river from Fort Okinakane to the mouth of the Wenatshapam, a right line from that point to the forks of the Sahpenis, and a right line thence to the Dalles of the Columbia. The soil throughout is uniformly light, shallow and sandy, and most of the country is sterile, barren and desolate, unfit for the purposes of agriculture, in its present state, and incapable of being reclaimed. The rivers are all mountainous in character; currents rough and rapid, and beds stony. The variation of the needle is east. This variation decreases from the coast as you proceed eastward to the main Cascade range; beyond which, in the same direction, it increases as you proceed. I am not aware that any exact ratio exists in this increase and decrease. The following examples will give some general idea of the state of increase and decrease:

At Olympia, the variation is	21°
At Fort Vancouver, the variation is	19° 45′
At Chequoss, the variation is	16° 5′
At Ketetas, the variation is	17° 34′ 41″
At Wenatshapam, the variation is	18° 50′ 27″

And it similarly increases towards the east. The minimum is about 16°.

I am, very respectfully, your obedient servant,

J. K. DUNCAN,
Second Lieutenant 3d Artillery.

Capt. GEORGE B. McCLELLAN.

9. NATURAL HISTORY REPORT OF DR. J. G. COOPER, NATURALIST, OF WESTERN DIVISION.

General Notes on the Natural History.

SIR: The country traversed by your division presents several well defined and very distinct zoological and botanical regions.

The limited time of the survey, and the extent of country traversed, do not afford sufficient data for defining the limits of these regions and their peculiar products with accuracy, but I will attempt, in the following sketch, to give some idea of their outlines.

It will be observed that there are two great regions very distinct and peculiar in their products, both animal and vegetable, that of the forests and that of the plains. The first of these is divisible into sub-regions—for example, the alpine summits of the mountains and the small prairies. The second also presents several sub-regions—for example, the rocky hills and the sandy valleys. The rivers and their immediate banks form a region which differs but little in products on either side of the Cascade mountains—all those met with being tributaries of the Columbia. All the above sub-regions differ more or less in the animals and plants peculiar to them, as may be seen from the collections made, and the notes in connexion with each of them.

From the time of leaving Vancouver, on the 18th of July, until we left the Cathlapoot'l river, our course was among the western spurs of the Cascade mountains. All this region was densely wooded, except a few small prairies.

The principal trees of this region were the three species of *Abies*, (spruce and fir,) one oak, two maples, one dogwood, one ash. The characters of the shrubs were two wild roses, three Spiraeas, an elder, and the "Oregon grape." Near the streams grew several species of raspberry, two poplars, and various willows, which were seen on the river banks throughout the country. Two species of huckleberry, a red and a blue fruit kind, were abundant in some parts. Very few plants were in flower in the forest, and but few on the plain, the dry season being accompanied by an almost complete cessation of vegetation. The small prairies met with were covered with a short growth of grass, then dried up, and around the borders of some was a dense growth of *Pteris*, (fern) reaching above a man's head, and almost impassable in places. Most of these prairies are covered by water in wet seasons, which prevents the coniferous trees from growing on them, and assimilates their vegetation to that of the river banks. Very few animals were met with during this time; the hot weather was probably a reason for their scarcity—driving them to the deep shade of the forests and the higher mountains, where a later continuance of rain affords better food for the deer, elk, &c. A few small hares, two kinds of grouse, and pigeons, were the largest game.

Leaving the Cathlapoot'l river on the 4th of August, we ascended by a steep and continuous acclivity to the higher parts of the mountains, about 5,500 feet above the level of the sea. Here the alpine region commenced, which shows itself chiefly in the different class of plants seen and in their late growth. The firs of the western slopes were replaced by two spruces, and a few pines and larches began to appear. The five snow-peaks seen at a distance showed that trees ceased to grow at about 6,000 feet above the sea-level, though vegetation continued much higher up.

Strawberries, which were gone at Vancouver by the middle of June, were here in abundance. A peculiar species of huckleberry, with large purple and finely-flavored fruit, abounded, with another producing blue fruit. On the highest hill ascended was found a low spreading juniper, very characteristic of alpine vegetation. The grass in most parts was still green, and many flowers continued to bloom. Showers of rain and hail descended during our stay. No animals were seen peculiar to this region, and nearly all those seen on the west side continued up to the highest point reached. Cranes, ducks, and geese were noticed—probably remaining up in these high mountains to breed.

On the 9th of August we commenced descending the eastern slope of the mountains, and at once noticed a marked change in the vegetation. Instead of the dense forest of firs covering the western side, the prevailing trees were two species of pines and a few oaks; these stood at distances of thirty and fifty feet apart, and the ground underneath was open, smooth, and covered with a good growth of grass.

A *Ceanothus* with fragrant, shining leaves, was the most abundant and characteristic, other shrubs appearing. Most of the plants of this region had passed flowering, and the soil was already very dry. Excepting a small prairie surrounding a lake, this forest continued on our course for about seventy miles. The plants found in flower on this side the mountains were nearly all collected. Very few animals were seen in the forest; a few elk, deer, and cayotes being the principal.

Approaching the borders of the plains, some plants peculiar to them were observed, generally scattered and stunted in growth. The pines also became smaller and more scattered, ending rather abruptly at last.

August 13.—We entered suddenly upon the plain region, which we continued to traverse for a great part of the remainder of the route. From observations made, I am able to mark out the western and northern limits of this region in Washington Territory. Commencing at the Columbia river, opposite the Dalles, the line of forest growth runs northwesterly, crossing the eastern spurs of the Cascade mountains, about as far as 48° of latitude. From here north it is less defined, the forests and plains being intermingled up to 49°; the summits and northern exposure of the hills being covered by forests, while the valleys and southern slopes are nearly destitute of trees.

Returning to the south from Fort Colville, we again met with the open plains a little south of the Spokane river, which may, therefore, be considered their northern boundary east of the Columbia. Towards the east the Cœur d'Alene mountains were seen, covered with forest, limiting the plain in that direction. "The Plains" comprise not only high and almost level table-lands, but steep hills and deep valleys. South of the Snake and Columbia rivers all the country passed through was of this character. The vegetation of these various sub-regions is very dissimilar; on the high spurs east of the mountains, commonly very stony and dry, scarcely any plants were flowering during our journey. *Artemisia* or "wild sage," and *Purshia* or "greasewood," were the characteristic shrubs. The withered remains of some umbelliferous and other plants were noticed, and grass was poor and dry. In the valleys a sandy but better soil presented several different vegetable sub-regions. The high gravelly terraces bordering some of the valleys were covered with a dry but dense growth of grass. Near the streams occurred some rose and cherry bushes, the usual poplar and willows, and a few small birch and pine trees, with some flowers still blooming. North of the Yakima the larch tree was abundant on the mountains, with the long-leaved pine and the black fir, in nearly equal proportions. Near Fort Colville a few birch trees of large size were seen, having a laminated bark, of which the Indians make canoes. The vegetation of the Spokane plains resembles that west of the Columbia river, as far as could be seen, from its withered state, when we passed through it. Among the animals peculiar to the plain region, the most remarkable are the badger, "sage fowl," sharp-tailed grouse or prairie fowl, horned lizards, and rattlesnakes.

South of the Snake river, to the north of the Wallah-Wallah, the country resembles that near the Yakima river, but the hills are better covered with grass, and the valleys more fertile. Several peculiar plants were seen here. From the southern banks of the Columbia, to the south-west, we could see a mixed country of high table-lands and undulating plains, with the wooded outline of the Blue mountains in the distance. After entering the gap of the Cascade mountains at the Dalles, the forest again appeared with a similar succession of trees from east to west (described) when crossing them (in the opposite direction) in August. A much milder climate prevailing on the west side of the Cascade mountains, was accompanied by the second flowering of several species of plants in November and December. Among those seen were the strawberry, blue and yellow violets, and various garden plants.

Besides the animals seen or collected on the route, several are said to inhabit the forests. The deer, (two species,) black bear, and a brown variety of lynx and racoon, are not uncommon. Beavers are said to be found on the streams, where the mild winters preclude the necessity of building dams to prevent the water from freezing too deep. The panther or cougar is also reported to be sometimes found. The mountain sheep undoubtedly inhabits the limits of perpetual snow—a skin being seen in possession of an Indian near Mount Rainier.

The rivers flowing into the Columbia have a peculiar animal as well as vegetable character, which is much the same on both sides of the mountains. Several kinds of water-bird frequent them, especially in the autumn, only emigrating to the west side in winter.

Three fine species of trout were obtained, but unfortunately destroyed; one of them appears to be peculiar to the streams on the eastern side. A few other kinds of fish were also seen. A collection of all the fresh-water shells seen was made. A species of crawfish was met with, even to the headwaters of its branches, and in the Columbia occurs eight and ten inches long. It is said to be a very good substitute for lobsters as an edible.

Respectfully, &c., J. G. COOPER, *M. D.*

Capt. G. B. McClellan,
Corps of Engineers, Commanding Expedition.

D.

SURVEY FROM THE MISSISSIPPI TO THE BASE OF THE MOUNTAINS.

10. REPORT UPON THE "DEAD COLT HILLOCK" LINE, BY LIEUT. C. GROVER, U. S. A.

FORT UNION, *August* 7, 1853.

SIR: On the 25th of June ultimo, I had the honor to receive the following orders from your office, viz:

"NORTHERN PACIFIC R. R. EXPLORATION, CAMP MARCY, PIKE LAKE,
June 25, 1853.

"DEAR SIR: You will, in charge of a detached party consisting of twenty-one picked men, two wagons and thirty-three animals, leave the Red River trail at this point, and crossing the Bois des Sioux near Lake Travers, and proceeding in the general direction of Dead Colt Hillock, continue your course to the mouth of the Yellowstone. Make the best survey of the country the means placed at your disposal will furnish. With the Schmalcalder compass, odometer, and the meteorological instruments, you will be able to get a reliable line and profile of your route. It is desirable, if practicable, to connect your line with Lieutenant Donelson's survey of the Missouri, at some eligible point, as Fort Berthold. Whether, and at what point this shall be done, is left to your own judgment. The great necessity is to reach the Yellowstone, and be in readiness for the work beyond. Your party has been selected with care, to enable you fully to accomplish its purposes; and I have the most entire confidence in its complete success. I shall continue on a more northern course, and, operating much with detached parties, I hope the labors of the expedition will result in a good exploration of the country from the Missouri to the Miniwakan lake. Lieutenant Donelson has instructions to survey the Missouri to the mouth of Milk river, and the country north of Fort Union, from White Earth river (western boundary of Minnesota) to the Porcupine. I trust you will reach Fort Union before the main party; in which case, assume command of the whole force brought together there, and communicate directly with the Secretary of War, should an opportunity to send letters occur.

"We shall undoubtedly hear of each other frequently on the route, and through Indian runners have the means of communicating with each other. With vigilance and firmness I have no fear of stampedes or disaster; and it is important that great care should be taken as to placing the least reliance upon any rumors of the sort. They will instantly be spread without the least foundation for them.

"Lieutenant C. GROVER,
"*4th Artillery, U. S. A.*"

Pursuant to the above order, my detachment having been organized, I left Pike lake about eight o'clock a. m. on the twenty-fifth day of June, and took up a course of north seventy-eight (78°) west. The general course I kept to a series of lakes known as Moose Island lakes, whence circumstances rendered it advisable to deflect some distance to the south, and follow up the eastern bank of Lake Travers and Bois des Sioux river to the crossing contemplated in my instructions. Between Pike lake and the Pomme de Terre river a more sudden declination occurs, leaving a valley from a mile to a mile and a half wide. The currents of these streams are rapid, and their bottoms sandy, with a width of about twenty (20) yards in ordinary stages of water. To the west of the last named river, for a few miles, this uneven country continues, gradually falling off to an almost perfectly level prairie, to the Bois des Sioux, with the exception of a slight rise near the Rabbit river. West of the Bois des Sioux, which is a broad, marshy stream, but with a sandy bottom at some few points, a similar level prairie extends to near Dead Colt Hillock, between which and James river on a direct line the country is high and bluffy. But by deflecting to the south, passing between Dead Colt Hillock and Lake Kandiotta, and crossing the

James river below the mouth of Grizzly Bear creek, there is no obstacle to a railroad line worthy of notice.

Thence, only gradually rising and falling surfaces occur on our line to the Wild Rice river, between the valley of which and that of the James river but moderate grades will be necessary.

On the 2d of July we camped on the right bank of the former stream, which was apparently somewhat swollen by recent rains. Its banks are sparely wooded with oak and elm, and rise from ten (10) to twenty (20) feet above its bed. This stream was kept to our right until the morning of the fourth, when we crossed it, leaving it some distance to the left.

The James river is about forty (40) yards wide, and pursues a sinuous course, with a sluggish current, through a broad, deep valley.

Below a small hillock known as Butte des Os, a very little wood is to be found; but opposite that point, and from the amount of drift upon the banks, probably above there, oak is quite abundant. The western bank gains its whole rise of about eighty (80) or ninety (90) feet above the bed of the stream within two miles, and extends back in broad undulations, having but slight differences in general level to the Coteau of the Missouri. Near the James river there occur many deep ravines, some of which have small streams of water in their bottoms, and upon their banks some scattering oaks. They extend back from the river some three or four miles.

The Coteau, so called, which I struck in forty-three (43) miles from Butte des Os, on a course of north 52° 30′ west, consists of broad ranges of high bluffs, thrown up without any particular order, to the height of about one hundred (100) feet above the general level of the broad plateau at its base. The country gradually becomes higher and more rolling as these bluffs are approached, and the actual point of change from rolling to bluffy can hardly be distinguished. For nearly thirty (30) miles on the line which I pursued after first striking the Coteau, this bluffy character prevails; after which it gradually falls down to rolling for about six (6) miles, when the trail again struck a point of bluffs. But all of this heavy country, after the first twenty (20) miles of the Coteau, can be avoided by deflecting four or five miles to the left of the line of march between camps July 10th and July 11th, and crossing to the right about six (6) miles from camp July 11th, and keeping around the bluffy points crossed by the trail on the 12th July, and within some four or five miles of the trail, in the same general direction, to the main branch of James river, which at this point is very small. The valley of this stream can be followed up, with but a slight deflection from the direct course, to near the head of one of its branches, about twenty (20) miles.

From thence to Mouse river the country is gently rolling. Following up the valley of the Mouse river, the same general topographical character is found to exist, as far as my reconnaissance extended, and this high bluffy country extends nearly in a general northwesterly direction as far as the 49th parallel of latitude, though its character becomes less abrupt as more northing is made. With regard to the soil, wherever deep cuts are necessary it has been found to consist of small rolling stones and gravel, intermixed with upland soil, and, as a general thing, such as to be easily worked. Granite and sienitic boulders, from a ton's weight downwards, are frequently found, but not in sufficient quantity to be of service as a building material. Sand is found in abundance at but one point, viz: Lightning's Nest, a series of sand-hills of several miles in extent, which would supply an inexhaustible amount for ballasting. Wood was not found in any quantity, except on the Mouse river, which is quite heavily timbered with maple, ash, and elm.

I am, sir, very respectfully, your obedient servant,

C. GROVER,
Second Lieutenant 4th Artillery.

His Excellency Isaac I. Stevens,
Chief N. P. Railroad Exploring Expedition.

11. REPORT OF MR. F. W. LANDER, ASSISTANT ENGINEER, OF THE CROSSINGS OF THE MISSISSIPPI.

ST. PAUL, *May* 22, 1853.

SIR: In receiving your instructions in regard to a reconnaissance of the upper Mississippi for a railroad crossing, I was directed to view this subject with reference to a feasible connexion with Lake Superior, to choose a point which should not interfere with steamboat navigation, and one that would occupy a favorable position for joining the main lines east. With these quite definite instructions to guide my examinations, I have made actual reconnaissance of the river from St. Paul to Fort Ripley, and beg leave to submit the following report:

At the ferry near the Falls of St. Anthony, at the rapids near the mouth of Sauk river, at several points for two miles above these rapids, at the ferry near Swan river, and at Little Falls, I have found locations for crossing the river with a railroad bridge. The first of these, near the Falls of St. Anthony, is about eight hundred (800) feet. It does not occupy so favorable a position in regard to a connexion with Lake Superior as either of the other points. The crossing is much greater in length, and the quantity of masonry larger, than at those farther north. The cost of this masonry is excessive, from the necessity of bringing the material for construction from Sauk rapids. The distance to "Dead Colt Hillock," a point near the course of survey, is not less by this crossing than by passing over the fine gravel country east of the Mississippi to Sauk rapids. The water is deeper and the current much more swift than at any of the other points. Passing west the country is thickly wooded, springy, entirely impassable for wagons, and inducing additional cost in grubbing and culvert masonry. I deem this crossing the least favorable of those I have examined.

Eighty miles north from the Falls of St. Anthony, at the head of steamboat navigation, and near the mouth of Sauk river, occur several favorable crossings, nearly similar in character. These, with the routes connected, should at some future period be subjected to a careful survey, the limited time allowed for the present examination necessarily confining my attention to reconnaissance. The first of them, near the mouth of Sauk river, is about five hundred (500) feet. By encountering the rapid current near the falls, excellent foundation for bridge masonry can be obtained upon the granite ledge of the section. Within two miles are five other points, none exceeding six hundred (600) feet in length. The adjoining ledge furnishes granite of suitable quality for heavy masonry.

I have estimated cost of bridge at Sauk rapids for a road-bed of twenty (20) feet as follows, viz:

500 feet Howe's truss, at twenty-five (25) dollars	$12,500
1,353 cubic yards bridge masonry, at twelve (12) dollars	16,236
Preparing foundations, say	1,000
	$29,736

Five miles farther north, near the mouth of river Watab, occurs a crossing four hundred (400) feet in length, with excellent foundations of granite ledge. This crossing is so situated as to induce cutting of about twenty (20) feet in hard material upon each shore of the river—say twenty thousand yards, at forty (40) cents, or $8,000. The adjacent ledge not being of suitable quality for building, the material for masonry must be brought from Sauk rapids. The location is neither so feasible of approach, nor possessing so great a facility for getting west, as that at Sauk rapids, although the passage of the river is shorter, and the current not so swift.

Twenty-four miles north of Watab, near the mouth of Swan river, is a crossing four hundred and fifty (450) feet in length. It has no advantage over those at Sauk rapids. The abutment foundations must be obtained by piling, and pier foundations adjusted by coffer-dam, or winter crib-work. The current is not swift; the water about eight feet in depth.

Four miles north of this point, at the island near Little Falls, is a very favorable crossing of three hundred and twenty-five (325) feet.

Four wing-abutments, and a slight increase of truss, will be required, from the destructible nature of the ledge foundation, which is slate-rock, strongly impregnated with iron, and affected by the atmosphere. Two short bridges would be necessary—one of one hundred and twenty-five (125) feet, crossing each branch of the river to island; thence embankment of one hundred and fifty (150) feet; thence bridge span of two hundred (200) feet over main channel of the river. The actual width of the main channel here is one hundred and seventy-five (175) feet, and the whole crossing the best upon the Mississippi from St. Paul to Fort Ripley.

The boulders upon the hill-sides in this vicinity afford good granite for light masonry. The magazine at Fort Ripley is built of these boulders, but they are not abundant, neither do they furnish blocks of sufficient size for exposed bridge abutments; the material for this purpose must be brought from Sauk rapids, thirty-two miles below.

The country on each side of the Mississippi, from St. Paul to Little Falls, presents facilities for railway construction I have never seen exceeded. One hundred and twenty miles of level or slightly rolling gravel plain supersedes all necessity for ballasting, and affords peculiar advantages for forming an embankment road-bed, the very best mode of construction for guarding against the snows and frosts of a northern climate.

Passing west from Little Falls, I find no serious difficulty to encounter over a route which had been represented to me as very severe. The country, to be sure, is broken, the ground springy, and the cost of moving material will evidently exceed that of the line east of the Mississippi. There is a greater quantity of earth to be excavated, and quite an increase in the amount of culvert masonry. Still, the surface presents a favorable aspect for good alignment. No cut will exceed twenty feet; there is no appearance of ledge; and, by exercising some degree of care in location, an excellent route can be obtained.

I have no knowledge of this line extending beyond Long prairie. It is represented to me as broken into sharp ridges, very swampy, and quite thickly wooded.

Summing up this matter, it seems evident that the proper course of the survey would be from St. Paul up the eastern shore of the Mississippi to Sauk rapids; thence, near the Red river trail, towards the headwaters of the Sauk. Sufficiently reliable information is afforded to prove to us that a very favorable route can thus be secured. The passage of the Mississippi is made at a point that does not interfere with steamboat navigation. It affords all necessary advantages to a communication with Lake Superior, is in a favorable position as regards an eastern connexion, and will thus insure the proper direction of capital in the location of private lines. The crossing at Little Falls is nearer a direct route from the Pacific to Lake Superior, and therefore worthy serious notice; yet it is evident that the interests of private companies should not be neglected, and that those operations should be fostered which, in efforts to develop the resources of this rich country, will add their share to the importance of our great enterprise, and aid in bringing it to a successful termination.

Passing through a country already forward in vegetation, and presenting every facility for expediting the progress of the survey, the route at Sauk rapids is superior to all others in the features required by your letter of instructions.

Submitting this result of my examinations, I remain, with respect, your obedient servant,

F. W. LANDER.

Governor Isaac I. Stevens,
Chief of Northern Pacific Railroad Exploring Expedition.

In reference to the best crossing of the Mississippi, in a report to me from Fort Union, submitted May 8, 1853, the opinion that the crossing at Sauk rapids should be selected was modified by Mr. Lander, and the reasons were given for preferring the Little Falls route as follows, viz:

In approaching the valley of the Missouri, the line crossing the Mississippi at Sauk rapids does not preserve the importance given it in former reports. The scarcity of suitable timber for bridging and the light structures required in partial grading of the road, that the railway may be used for transportation of material for forwarding it to an early completion at low cost, cannot be too fully considered. For this reason, I will again refer to the route by the Little Falls, already given an important character in my report of the crossings of the Mississippi. The route by Little Falls does not occupy so favorable a position in regard to an eastern connexion as that crossing the Mississippi at Sauk rapids, but is more nearly direct towards Lake Superior. The crossing is the best upon the Mississippi, and the facilities for construction very great. While passing through the pine region of the northern Mississippi, and the wooded district extending to the Red river, it assumes a high character—viewed in connexion with the present subject—"the scarcity of timber for building purposes in the vicinity of the Missouri."

In a report submitted February 15, Mr. Lander says: "It appears, then, that, from the great scarcity of timber upon the second division of the route, the first division should pass through a timbered region. The difference in cost between the route by Little Falls and that by Sauk rapids is probably very little. The route from Little Falls to the Bois des Sioux is represented as passing over high, sandy plateaux, broken by low ridges, and interspersed with shallow swamps. The upland country is well-timbered with the eastern pine, and the swamps filled with excellent cedar. There would be an increase of culvert masonry upon this route for the purpose of drainage through a low, wooded country, and extra cost in grubbing, but the crossings of the Chippewa and Tipsina rivers occur near their sources, and the line generally preserves a better character than that near the odometer survey, and which crosses the Mississippi at Sauk rapids."

12. REPORT OF MR. A. W. TINKHAM, ASSISTANT ENGINEER, OF HIS RECONNAISSANCE OF THE "THREE BUTTES," AND OF HIS RECONNAISSANCE OF THE ROUTE.

WASHINGTON, D. C., *July* 7, 1854.

DEAR SIR: On the morning of September 3, 1853, I separated from the train of Lieut. Donelson, and entered upon a reconnaissance, following up the valley of Milk river some fifty miles, crossing over the "Trois Buttes," the Trunk of the Prairie, and the "Knee," in the route to Fort Benton.

These first named isolated mountains, separated from each other, and from whose bases in every direction the prairie stretches in its almost unbroken monotony for long distances, had within a day or two first come into view, and on the day previous to the one on which I commenced the reconnaissance I had been out in the smooth, dry prairie separating Milk and Marias rivers, noting their partially-discovered outline, and endeavoring to find their position.

A direct march from Lieut. Donelson's camp, noted September 2, would have saved considerable distance here; a straight line would have carried us over a dry, parched prairie, nearly stripped of grass, without wood or water. For these reasons I followed the valley of Milk river some fifty miles, and until within about thirty miles of the base of the most easterly of the Trois Buttes, and then was able, with a single day's march, to reach the base of the mountains, where were water, grass, and wood in abundance.

In this interval of fifty miles, Milk river bottom is marked by the same character of Mauvaises Terres bluffs which at intervals distinguish it lower down; steep, irregular, broken slopes of clay and sand, destitute and naked of all vegetation, with the outcropping tertiary sandstone in layers or blocks. The cotton-wood growth, growing thinner from the commencement of our journey, ceased wholly in the distance of twenty miles, and for thirty miles perhaps not a single tree is to be found. The bed of the river, more dry than lower down, is wide and shallow, five or six hundred feet wide, and but a few feet below the intervale. Water is rarely found, and then only in some hole sheltered by the overhanging bank; and the destitution of wood, the naked, barren slopes walling in the intervale, the almost total absence of animal life, the whirling, drifting sand of the dry river-bed, give to this portion of Milk River valley, in the chilliness of an autumn day, as we travelled it, the character of desolation and dreariness. The river turns frequently, and more abruptly than lower down, and is not favorable as a railway route, and offers no place so feasible for leaving the valley and gaining the prairie as the one decided on in the vicinity of the camp of September 1.

At our late camp on the river-bottom, our point of departure from Milk river, when we took a direct course for the Three Buttes, we halted under a clump of cotton-wood trees, the first we had seen for thirty miles, with good wood, luxuriant grass, and sufficient water in the holes of the river-bed. In this vicinity, washed down by the water, detached fragments of lignite were of frequent occurrence.

On the 5th of September, at night, I reached the east base of the most eastern of the Three Buttes.

The river, where I left it, I found to be about thirty miles distance from our camp of that night. With the exception of two or three series of coulées, making down into the main valley of Milk river, the route during the day lay over the dry prairie already noticed as lying between Milk and Marias rivers. In these coulées, with their numerous branches cutting the country in deep channels, difficult of passage, we noticed the frequency of fossils and of lignite in place. The layers of lignite were sometimes six feet in depth, but most of this was occupied by layers of very inferior quality, only a small portion being black and hard. I had no opportunity to examine anything more than what happened to fall in my way.

Our camp at the eastern base of the mountain was not gained until night, and the gathering rain obliged us to take such quarters as happened to befall us, without much opportunity for selection. We camped in a gully, worn by water through a light gray sandstone, with the animals above us with good grass. At the bottom of the gully was a spring, whence meandered a small rivulet, whose belt of green marked its course through the browned plains, until it was absorbed and disappeared. Antelope had been tolerably plenty during the day. The wild cherry and black gooseberry were abundant near our camp. The sandstone, a formation of considerable extent, a thick stratum which the water has sometimes cut into a channel seventy-five feet deep, is a light gray, coarse stone, and will answer very well for ordinary masonry, and apparently could be easily worked.

September 6th was spent in making the ascent of the mountain. The rain fell heavily during the early part of the previous night, and the morning sun discovered the overhanging peaks of the Buttes, glittering with a pure white covering of snow stretching far down their slopes, and contrasting brilliantly with their dark masses of evergreen growth. Occasionally riding, but oftener walking and leading our animals, early in the afternoon we gained as near the top as it was desirable for the whole party to go. Leaving the animals and most of the party to proceed to camp on the western slope, on foot I made my way to the tops of the two principal summits of the eastern of the Trois Buttes. Our ascent had been one of continued excitement and interest.

For months we had been confined to the monotony of the smooth bleak prairie, and had missed the rocks and trees, the hills, and brooks, to which we were accustomed, and as we again were suddenly thrown among them with all their novelty and pleasant associations, our spirits were strangely exhilarated, and every familiar stone and shrub possessed a rare charm.

The mountains are perhaps half covered with a small growth, chiefly of pine—a small pitch-pine—straight, eight inches to two feet through, and spruces of the same size; and the other half is made up with grassed slopes, a thrifty, abundant growth, sometimes reaching to the higher peaks, or with steep embankment-like declivities of loose sliding stones, which, displaced by the feet of the buffalo and deer, and traced with numerous paths, gave a foothold for ourselves and horses.

The game was abundant; a large elk was shot in the earlier part of the day; antelope were more plenty than we had before seen them; some black-tailed deer were seen, a big-horn, and occasionally a rabbit or hare crossed our path.

The wild cherry and gooseberry were abundant; and besides, there were the strawberry vine, the raspberry bush, blackberry bush, the ground juniper, and other familiar plants.

After the sandstone was a dark slaty-looking stone, soft, and crumbled on the surface, which was supposed by Dr. Suckley, to whom I gave the specimens collected on this line, to be carbonate of lime. Porphyritic and common trap stones were also in place. Perhaps the most valuable stone is a white marble, at times of alabaster clearness and purity. Many of these stones would be useful in building, and there is little doubt that a suitable exploration would prove them to be conveniently accessible.

The snow of the previous night had not been wholly obliterated by the warm sun of the day, and was an agreeable incident to the closing part of the somewhat laborious and heated ascent.

The view from the two summits, of about the same height, and which were mounted in succession, is of vast extent, and embraces objects of striking interest. East and north you trace the windings of Milk river. In the same direction, off in the distance, is Cypress mountain—not mountain-like in appearance, but apparently a sloping, gradually rising elevation of ground. Not as far off as the mountain, and beyond what appeared to be Milk river, could be seen a lake of considerable extent. Here we had our first view of the Rocky mountains. One hundred miles or more distant, they terminated the view from northward to southward, gradually falling towards the horizon in the latter direction. The snow of the previous night had evidently extended to them, and the imposing mass abruptly opposing itself like a forbidding wall, terminating the smooth stretch of prairie reaching to its base, was gorgeous with its glittering peaks and flashing snow-fields, lit up with unusual brilliancy by the evening sun. It is characteristic of the mountains to the north of Sun river, that at first view they generally present a seeming unbroken front; and though a nearer approach discovers openings hid from view in the distance, and some of which future exploration may possibly show to afford practicable passages of the mountain, we were, at the Three Buttes, too far distant to detect any such favoring gaps, and the mountains were before us, an unbroken and apparently impenetrable barrier.

South and southeast could be seen the mountains beyond the Missouri, in the direction of Fort Benton, and near the Bear's Paw range. The Marias River valley was not distinguishable, but its tributary rivulets, emanating in the mountain, could sometimes be traced for a long distance. Most of the small rivulets, in this dry season of the year, are absorbed and lost before passing beyond the limits of the mountain slopes.

The sun had set as we left the tops of the mountains; the air was growing cool and chilly; the thermometer at 37° Fahrenheit, and rapidly falling. The barometer gave the height of the three mountains about 3,300 feet above the prairie at its base, and (I speak from recollection only—the record of the observations were with the general records now missing) about 6,700 feet above the sea. To me they are objects of singular curiosity. Distinct from each other, and isolated from any mountain group, they have been thrown up high above the surrounding country, and have long served as the watch-towers and land-marks of the roving tribes ranging for a thousand miles distance north, south, east and west. Assiniboins, Crows, and Blackfeet, all know them well in their geography, and their summits are marked with their monumental stone heaps, and retain the lodges where some war party has waited the favorable moments to pounce upon the unguarded and isolated wanderer of the plain below.

The descent to our camp was very rapid—as rapid as the steep slopes would admit; and before dark we gained the bottom of the ravine, whence the sight of the curling smoke and bright fire-light had advised us where to look for the rest of the party. The night was clear and frosty, and the clear sparkling brook washing the small stones in its bed, with the wooded and dark slopes shutting us in, made our encampment strangely unlike the bare prairie to which we were accustomed.

The next day we completed the descent, passed between the remaining two of the Three Buttes, and before night were again on the smooth prairie, and encamped that night at dark about twelve miles south of the most westerly of the Buttes, without water or wood. Our course was to the Marias river, and we hoped to fall upon some small tributary which would afford us water, but every promising hollow and valley only served to disappoint us with its dry bed. The ground continues rolling for some distance after leaving the Buttes, and some sixteen miles west of our camp was a very prominent and high bluff, called Snake's Head. We went no nearer to it. Game, especially buffalo, was plenty during the day. It was on this evening that I lost my horse. The old man, Monroe, whom I took with me as interpreter in case we fell in with any bands of Blackfeet, was very uneasy during our stay on the Buttes, and hardly seemed to act or breath freely until we were again on the prairies, and with an unobstructed sight. Passing so much of his life among the Indians, he had all their superstitious fears; and recalling every Indian story of combat and murder connected with these mountains, his mind seemed really confused under the superstitious dread which weighed upon him, and he acted with more than ordinary forgetfulness. Riding side by side, his rifle must have been cocked, and the motion discharged the gun, the ball passing into my horse just back of my leg. I was obliged to abandon her on the spot, one of the party after that generally walking by turns. She was a fine mare, a pet with me, and as I looked back upon the spot where she had lain down exhausted, after struggling to follow the other horses, it was with a sadness such as one feels for the loss of a more intelligent object of affection.

On the next day, September 8th, I reached Marias river, after a march of a little over twenty-six miles. The route was over the dry rolling prairie, and parched and sterile, occasionally crossing the dry bed where at some time flowed a tributary brook of the Marias river, or the dry and parched bottom of a shallow lake. Starting without breakfast, it was near noon before we found any water, and then we obtained it from some small pools of standing but palatable water, for which we were probably indebted to the recent rain. Marias river, where we touched it, has the same characteristics as lower down—flows in a deep channel two hundred to three hundred feet below the prairie level, and though tolerably well wooded with cotton-wood, is hid from sight until one is close upon it. The valley is frequently broken with coulées. The bed of the river is two hundred to three hundred feet broad; water at that time one hundred and fifty feet wide, two to four feet deep; banks eight to twelve feet high, of sand and mud. Pebbly bottom, swift current, water slightly milky.

A handsome band of elk, some twenty or twenty-five in number, headed by a stately buck, walked leisurely past our camp on the opposite side of the river.

Fording the river here, and passing on to its western banks, some eight miles' farther travel brought us to the "Trunk of the Prairie," a box-like prairie elevation, not particularly prominent, but from whose top I obtained a fine general view of the Rocky mountains, and of the country at their base. Here we again saw droves of buffalo.

After obtaining this point, I turned southeasterly towards Fort Benton, travelling in a direct line from the "Knee," by my estimate thirty-seven miles distant, and which I did not reach until the close of the next day, September 10. This is all prairie country, and of somewhat better character than to the northeast of Marias river. It is, however, very scantily watered, and is destitute of wood. In this distance of thirty-seven miles I passed over one considerable brook-bed, where there was no running water, but an abundance of good water standing in the deeper parts of the channel, and no wood. There is evidently here at times a considerable flow of water. Besides this we saw but little water, and there was no wood.

The buffalo-dung was sufficiently plentiful for fuel.

From the "Knee," a square detached butte, of perhaps half a mile wide, with a fortress-like look, and accessible with horses at only a few points, I had another view of the Rocky mountains, the country watered by the Teton, and of the prairie to the eastward, and then was able to trace the general route desirable for the railway after leaving Milk river, The Missouri river mountains were also in view. Camped on the Teton, about five miles from the "Knee," groping into camp late in the evening, having marched about thirty-three miles without water, and one of the mules having given out. Here we had good water and wood and tolerable grass. At this camp I remained the next day, the Sabbath. The Teton here resembles the Marias river, though a smaller stream, flowing deep below the prairie, fringed with cotton-wood, was sixty to two hundred feet wide, one to three feet deep, freshet-marks about eight feet above the water-level; at that line, width of interval one thousand feet.

From this camp the same smooth prairie continues until terminated by the bluffs and coulées of the Missouri river; and save that we once more crossed the Teton, having about the same character already noticed, the balance of the journey does not require remark, and the route soon crosses the more thoroughly explored line travelled by the main train.

September 12th.—I reached Fort Benton late in the evening, after a ride of some thirty-five miles, closing this reconnaissance of about two hundred and ten miles in extent, and occupying ten days' time.

Its chief value is the continuation of the survey of Milk river above where the odometer survey left it; the examination of the general character of the country between Milk and Marias rivers; the partial reconnaissance of the "Trois Buttes," discovering much that may prove valuable in these mountains of wood and stone, with more or less of land capable of tillage; the intersection of Marias and Teton rivers, with other surveys, enabling us to plot those rivers with a good degree of accuracy; and the description of the practicable railway character of the country from Milk river to the upper valley of the Teton river.

Its plot was long since incorporated in the general maps of the survey; the barometric observations, few in number, but characteristic, were at Olympia among the meteorological records, with Lieut. Donelson, and probably are included in the missing records. The mineralogical specimens were turned over to Dr. Suckley.

I am, sir, very respectfully, your obedient servant,

A. W. TINKHAM.

Governor I. I. Stevens,
Chief N. P. R. R. Exploration, Washington, D. C.

13. Report of doctor John Evans of his route south of the Missouri and Yellowstone, and between the Milk and Missouri rivers.

[This paper, sent from Washington Territory, where Dr. Evans was still employed in the field when the report of Governor Stevens was submitted, was lost on the route.]

E.

NAVIGABILITY OF THE MISSOURI.

14. REPORT OF LIEUTENANT A. J. DONELSON, CORPS OF ENGINEERS UNITED STATES ARMY, OF HIS SURVEY OF THE MISSOURI TO FORT UNION, AND OF HIS RECONNAISSANCE OF THE COUNTRY IN THE VICINITY OF FORT UNION BETWEEN THE WHITE EARTH AND THE BIG MUDDY RIVER.

OLYMPIA, WASHINGTON TERRITORY,
March 8, 1854.

SIR: Having already rendered you a general description of the Missouri river from its mouth to the Poplar, and of the country in the vicinity of Fort Union, I have the honor to submit the following report, which, with the accompanying map and tables, comprises all the information obtained by the party under my charge in the months of May, June, and July, 1853.

The party for the survey of the Missouri consisted of Lieutenant John Mullan, first artillery, Mr. W. M. Graham, and one sergeant, two artificers, and three privates of the United States company of sappers and miners. Lieutenant Mullan was placed in charge of the meteorological observations, in addition to which he assisted in making the topography. Mr. Graham was the astronomer; Sergeant Collins assistant topographer; and the remainder of the sappers aided in the several duties.

The steamboat Robert Campbell, in which we had engaged passage, was propelled by a double engine, and had been a first-class Missouri river packet. Her tonnage was about three hundred, and she had on board near the maximum load, drawing about five feet of water.

The operations pursued in making the survey were briefly as follows: Meteorological observations were generally taken at every halt. Astronomical observations were made whenever practicable at the halts. A topographical sketch was taken to the mouth of the Poplar, from a point about twenty miles above St. Joseph. For this purpose, Lieut. Mullan, myself, and Sergeant Collins generally performed in turn the work of running courses, estimating distances, and of mapping. The sketch is continuous, except what should correspond to the portions of the map of the river drawn in dotted lines: as for these, the notes were in one case lost; and for the rest, the courses were travelled after dark. The connexion was made by drawing the portions in dotted lines from our notes, and from the maps of Lewis and Clark, Nicollet, and others.

Hourly soundings were taken from near the mouth of the Big Sioux to Fort Union. Notes were made of all the features of the river and adjacent country, as observed from the steamboat, and all information practicable was obtained from gentlemen of the Fur Company, and traders and voyageurs. In constructing the map, the data obtained by Nicollet and others, who formerly surveyed the river, have been freely used, as the object was to obtain accuracy by combining all the reliable results which have ever been obtained. The map of all that portion of the river below the point at which we commenced sketching has been drawn by adding our own observations to the best maps already published. Having left St. Louis at half-after twelve o'clock on the 21st of May, we entered the Missouri a little while before sunset, and found that river high, the water muddy, and current rapid.

The Missouri enters the Mississippi in latitude 38° 50′ 50″ north, and in longitude 90° 13′ 45″ west of Greenwich. Below the mouth of the Kansas it pursues a direction nearly east, lies almost entirely within the State of Missouri, and is about three hundred and eighty-two miles long. Its banks are here almost continuously settled, while all the more prominent localities are occupied by flourishing cities, towns, or villages. The soil is of surpassing fertility, and the adjacent country rich in coal, iron, and other minerals. Cotton-wood is the prevailing growth in the bottoms, while willow is very abundant at the water's edge, and sycamore near the river and its tributaries; but there are also found, in great abundance, principally on the slopes which limit the immediate valley of the Missouri, the oak, walnut, ash, elm, and maple. The islands are very numerous, and some of them several miles in extent. They do not, as higher up the river, appear to owe in part their existence to the entrance of tributaries. They have nearly all a rich soil, but are kept by the action of the current in a transition state, either increasing in size from the constant deposition of new material, or undergoing destruction in consequence of the current driving against the islands through changes in the channel of the river.

Those changes are very marked in this river, which may be observed in nearly all streams, and which are or arise from the detrition of the banks on one side, and the formation of new ones at corresponding points generally on the opposite side. The detrition principally takes place on the side of the main channel, as along the outer circle of bends. The current is only effectually checked when, after it has encroached in one direction for some time, it encounters the rocky bluffs which border the river valley. The growth of timber only delays its action; for there were noticed, in a great many instances, large and flourishing trees, roots and all, which, with the earth they grew in, had fallen into the river, and were floating down to sink or be caught on some sand-bar, and thus to become a snag or sawyer, or perhaps a nucleus around which should be formed an island. The first settlers must have suffered very much from these causes; others, as those who have located below and in the vicinity of Council Bluff city, have avoided their ill effects by placing their improvements as far from the river as practicable.

The destruction of the banks is not in all cases gradual, for I saw many instances to the contrary, and had reliable information that often an extent of several acres of land disappeared in a moment.

During a great part of our voyage, those changes, of which mention has been made, were much more marked on the right than on the left bank of the river; which may be accounted for by the fact that, while the river is confined in its course between two nearly parallel ranges of bluffs, it appears tending to approach the more westerly, and, as a consequence, must encroach principally on that side. It was noticed that many of the principal bends were turned towards the west.

I was informed that at some points the banks disappear more in low than in high water; and this may be explained by supposing that the strong current, while it loosens the mass, supports it in its position as long as the water is high. One good effect resulting from the formation of these obstructions is, that it tends to give the river a sinuous course, which diminishes the velocity. As in the case of the Mississippi, so in this, if the river were straight the velocity would be too great for the purposes of navigation.

It results from the continually recurring changes to which the Missouri is liable, that at nearly every bend there is a sand-bar or island, and a series of snags and sawyers. These also generally occur wherever from any cause the water is still, or there is a counter current, and where there are eddies or whirlpools. The difficulty in navigation is to discover in season a continuous unobstructed channel. Concealed snags and sawyers are liable to occur in any part of the river.

The average velocity of this portion of the Missouri is a little over five miles an hour. By a rough measurement, made at Howard's Landing, not far above Boonville, I found the width to be about half a mile.

Some of the characteristics which I have not mentioned of this portion of the valley of the Missouri are, that the tributaries have generally much clearer water than the river itself, and are, from the depositions which there take place, narrower at their mouths than elsewhere; that the smaller of the tributaries lie, for the most part, within the two parallel ranges of bluffs; that, in many instances, the bottoms may be said to be swamp-land, being occupied by numerous marshes, lakes, ponds, and sloughs, which diminish the value of the exceedingly rich land, and must cause the intermittent and other fevers to prevail to some extent; that the banks of the river are heavily wooded from the mouth of the Kansas to the Mississippi, there having been observed by myself but one locality, and that near the mouth of Grand river, which could be called a prairie; and that the two ranges of hills which limit the valley of the Missouri were judged to be from seven to fifteen miles distant from each other—the eastern range touching the river at St. Charles, Portland, Glasgow, Brunswick, and other points; and the western below St. Charles, at Jefferson city, Boonville, Howard's Landing, Lexington, Camden, Liberty Landing, &c. The two continuing parallel to each other, and consequently diverging from the river between the points above mentioned.

Besides these characteristics, I will mention that the coal measures are the principal geological formation near the mouth of the Missouri, the magnesian limestone near Jefferson city, and the carboniferous limestone and coal measures from Howard's Landing upwards.

The town of Independence, not far below the mouth of the Kansas, and situated in a bend of which the arc is twelve miles and the chord three miles long, is connected by travelled roads with Santa Fé and with Fort Laramie and the South Pass. Kansas, near the mouth of the river of that name, is also so connected.

Between Fort Leavenworth and the mouth of the Missouri, the principal tributaries are the Osage, Grand river, and the Kansas. The first is about three hundred and fifiy yards wide at its mouth, but a little wider just above. It is navigable six months in the year for about two hundred miles, or to a point thirty miles beyond Warsaw, although steamboats have, in very high water, been to Harmony station, which is beyond the frontier of the State. Grand river is about two hundred yards wide at its mouth, and is navigable for steamboats, although the interests of trade do not now cause it to be used for that purpose. Kansas river unites with the Missouri at an angle of about 150°. A low bottom, nearly a mile wide and several miles long, occurs just below its mouth. The angle between the two streams was probably, in former days, about 80°; but a deposition having taken place at the mouth of the Kansas in the same manner that islands are continually forming in the Missouri, and being partly caused by the difference in velocity of the two streams, the Kansas has shifted its channel to the north. It is about 300 yards wide at its mouth, and, with the exception of two sets of rapids, open for navigation for about 150 or 200 miles. The rapids, I was informed, could be improved at a moderate cost. Flowing as it does through a tract of country which is not in any other way accessible to steamboats, and which possesses many resources, the Kansas must assume some importance at a future day. I did not see its valley above its mouth, but, having formerly travelled over the country for some hundreds of miles west of Fort Leavenworth, can say that the valleys of the streams, for at least 150 miles west of that post, are favorable for agricultural or grazing purposes; and from their proximity to the Kansas, as well as from information received, I would infer that its valley has the same advantages.

In our ascent of the river, we proceeded at the rate of about five miles an hour, halting nearly two hours every day for the purpose of procuring wood. The ordinary price of this along the banks of the river was from two to two and a half dollars per cord, according to quality; and the consumption of it by the steamboat at the rate of about two cords per hour. We reached Howard's Landing, five miles above Boonville, at 12 m. on the 24th of May, and halted there until nine o'clock in the evening, for the purpose of repairing some part of the boat's machinery. We found the current very rapid at Brunswick, but met with no other obstruction at this point. There was formerly a large island opposite this town, and it has not yet entirely disappeared. The current was observed to be more rapid between the island and right bank shore than next the outer side of the elbow. On the night of the 25th and on the 26th, above Brunswick, the steamboat was much delayed by sand-bars. In running on one of these, the ordinary events which transpire in rapid succession are the harsh and grating noise heard, the trembling motion communicated to the steamboat while being brought to a state of rest, the inclination from stem to stern which it is at the same time caused to assume, the ringing of bells to stop the engines and to cause them to work backwards; and then, this failing to relieve the boat from its awkward position, the resort to the double set of spars, pulleys and tackling, with which every Missouri river steamboat is furnished. The discovery in season of a continuous unobstructed channel is generally easily made by the skilful pilot when there is nothing to interfere with his vision;

the slightest ripple on the surface of the water above a sand-bar, and the divergence of the current, which occurs near a concealed snag, however unapparent to an ordinary eye, are unerringly detected by him, when he can distinguish objects at the supposed distance. But sometimes the channel has an oblique direction, and over the entire cross section of the river indications of obstructions may be seen. It may accordingly be inferred how much more dangerous is the navigation by night than by day, and how great must be the difficulties when the night is entirely dark. We reached Lexington a little after noon on the 26th, and obtained there about five hundred bushels of coal. Just above this town the river was found to be very rapid. The points which in this report are mentioned as being particularly rapid, were generally such that our steamboat, when struggling directly against the current, made very little or no progress. We passed them in taking advantage of the current by diagonal steering, and by using rosin, pitch, &c., to increase the tension of the steam. Not far from Lexington, we passed, on the 26th, a short turn in the river with a rapid current, and called "Devil's Bend."

The permanent obstructions in the river below the mouth of the Kansas are a chain of rocks about twelve miles below St. Charles, and one a little below Sibley. I could obtain no facts as to the effect these now have upon the navigation.

I have thus, with the exception of stating some facts as to the climate, statistics of navigation, &c., which will be done farther on, described that portion of this river which lies within the State of Missouri. As most of the characteristics I have mentioned are applicable to the other portions of the river over which we travelled, I shall, as a general thing, enter, in the following part of this report, into a particular description only when the character of the country or river is essentially different from that which has been considered. I have dwelt somewhat on the changes which take place in the positions of the banks of the river and its channel. These occur in a similar manner, but in different degrees, at successive points along the whole of the Missouri that was surveyed.

As the lower subdivision of this river is far more important than any other, so also is the State of Missouri than any other part of the vast tract of country watered by this stream. That State, with its great agricultural and mineral resources, from its central position, its connexion by travelled roads with all the territories as well as the two great harbors of the Pacific, and the facility of communication by navigable streams with the extreme northern and southern portions of the Union, will, it seems to me, be very important as a source of supply to any line of *railroad* which may be directed across the continent.

The next portion of the river to be considered is that which is included between the rivers Kansas and Nebraska or Platte; this division of the subject into parts being adopted more for convenience than anything else.

The Missouri, from near the mouth of the Kansas to near the parallel of 40° 38′ north latitude, or about the middle of the island of Grand Lebouter, separates the State of Missouri from the Indian territory, and from that point to the mouth of the "Big Sioux" it separates the State of Iowa from the Indian territory.

We passed the mouth of the Kansas at about forty minutes past 4 o'clock p. m. on the 27th. Fort Leavenworth we passed at about half-after 10 o'clock a. m. on the 28th. This place is beautifully situated upon a commanding eminence on the right bank of the Missouri. The country to the west of it, for some twenty or thirty miles, to the vast prairies, is an alternation of hills and valleys, of prairies and woodland. The valleys are fertile, and some of them under cultivation. The occurrence of woods here, for many miles back from the river, serves in some degree to show that throughout a great part of its extent the country adjacent to the Missouri would be sufficiently wooded were it not for the annual fires.

We had some difficulty in stemming the current above and below Weston. Not far above that point a marked change took place in the appearance of the river. The water seemed clearer, the current less rapid, and the islands, which were nearly all on the left side, were fewer and of older formation than was the case lower down the river. Both banks, whether low ground or hills, were well wooded; but on the right bank, those prairies which extend to the foot of the mountains were not far off, while on the left the belt of thick woods was of about the same width, being succeeded by an alternation of prairies and woods.

On one occasion we entered, just after we had turned from southwest to west, a long and straight portion of the river. From the lower end of this we could see Independence prairie at some miles off, and which appeared to cross the river from west to east. We halted near this at 9 p. m., and remained until the next morning.

The distance from Weston to St. Joseph is, by land, twenty-eight miles, by water sixty miles. The river is very tortuous between the two points, flowing in its course towards every point of the compass.

Several miles before we reached St. Joseph, the beautiful prairie on which it is situated appeared in view. It was of vast extent, and covered with a brilliant verdure. Behind it, to the east, were thinly-wooded hills, which appeared to range in a southeast and northwest direction. St. Joseph, a flourishing town of about five thousand inhabitants, was formerly an important, and is now, as I was informed, a minor rendezvous for California and Oregon emigrants, there being a good road from it to Fort Laramie and the South Pass.

As at most of the places on this part of the Missouri where observations could be made or information obtained, the growth where we halted, opposite St. Joseph, consisted of cotton-wood, elm, ash, box alder, maple, bass-wood, mulberry, dog-wood, and oak.

By rough measurement, I found that the width of the river just above St. Joseph was four hundred and sixty yards, and the velocity of the current three miles per hour; but this appeared much less than that near the left bank, where was the main channel.

On the 30th and 31st we passed the rivers Nodawa, Little Tarkio, Big Tarkio, Big Nemahah, Nishnabotana, and Little Nemahah, which are respectively seventy, eighty, fifty, and forty yards wide at their mouths.

Some of the islands, and in some places the channel, of this part of the river, do not appear to be subject to those sudden changes which have been described. The Great Nodawa island, with the channel on its eastern side, and some others, are now about as they were when described by Lewis and Clark. The growth of cotton-wood and willow, which commences as soon as the island is formed, protects it to a great extent from the action of the current.

On the 30th and 31st the river continued in most respects of the same character as heretofore. The soil was observed to be very sandy and poor in some places on the 30th. The quicksand banks, which are occasionally found along this portion of the river, are very destructive to cattle, they being sometimes inextricably mired in them, as they come to the river to water. On the 31st we passed Iowa Landing, where is a ferry, and whence is a road connecting with the emigrant road to Oregon and California.

The river at this place varies in width from four hundred yards to half a mile.

On the 1st of June we passed Old Fort Kearney, which is situated on the right bank at the mouth of Table creek; it was formerly occupied as a military post. Bolly's Point, on the opposite side of the river, is connected by a ferry with Old Fort Kearney, and with the road which leads thence to the west.

This road leads to Fort Kearney on the Nebraska, and thence to the South Pass. It is, I believe, from fifty to seventy miles shorter than the road which leads to those points from Fort Leavenworth.

We found the river very rapid at Bolly's Point. It was observed to be more tortuous than for several previous days.

At Linden Landing, which we passed before coming to Old Fort Kearney, the Nishnabotana river approaches to within one hundred yards of the Missouri, and is there one hundred and the slightest ripple on the surface of the water above a sand-bar, and the divergence of the current, which occurs near a concealed snag, however unapparent to an ordinary eye, are unerringly detected by him, when he can distinguish objects at the supposed distance. But sometimes the channel has an oblique direction, and over the entire cross section of the river indications of obstructions may be seen. It may accordingly be inferred how much more dangerous is the navigation by night than by day, and how great must be the difficulties when the night is entirely dark. We reached Lexington a little after noon on the 26th, and obtained there about five hundred bushels of coal. Just above this town the river was found to be very rapid. The points which in this report are mentioned as being particularly rapid, were generally such that our steamboat, when struggling directly against the current, made very little or no progress. We passed them in taking advantage of the current by diagonal steering, and by using rosin, pitch, &c., to increase the tension of the steam. Not far from Lexington, we passed, on the 26th, a short turn in the river with a rapid current, and called "Devil's Bend."

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By rough measurement, I found that the width of the river just above St. Joseph was four hundred and sixty yards, and the velocity of the current three miles per hour; but this appeared much less than that near the left bank, where was the main channel.

On the 30th and 31st we passed the rivers Nodawa, Little Tarkio, Big Tarkio, Big Nemahah, Nishnabotana, and Little Nemahah, which are respectively seventy, eighty, fifty, and forty yards wide at their mouths.

Some of the islands, and in some places the channel, of this part of the river, do not appear to be subject to those sudden changes which have been described. The Great Nodawa island, with the channel on its eastern side, and some others, are now about as they were when described by Lewis and Clark. The growth of cotton-wood and willow, which commences as soon as the island is formed, protects it to a great extent from the action of the current.

On the 30th and 31st the river continued in most respects of the same character as heretofore. The soil was observed to be very sandy and poor in some places on the 30th. The quicksand banks, which are occasionally found along this portion of the river, are very destructive to cattle, they being sometimes inextricably mired in them, as they come to the river to water. On the 31st we passed Iowa Landing, where is a ferry, and whence is a road connecting with the emigrant road to Oregon and California.

The river at this place varies in width from four hundred yards to half a mile.

On the 1st of June we passed Old Fort Kearney, which is situated on the right bank at the mouth of Table creek; it was formerly occupied as a military post. Bolly's Point, on the opposite side of the river, is connected by a ferry with Old Fort Kearney, and with the road which leads thence to the west.

This road leads to Fort Kearney on the Nebraska, and thence to the South Pass. It is, I believe, from fifty to seventy miles shorter than the road which leads to those points from Fort Leavenworth.

We found the river very rapid at Bolly's Point. It was observed to be more tortuous than for several previous days.

At Linden Landing, which we passed before coming to Old Fort Kearney, the Nishnabotana river approaches to within one hundred yards of the Missouri, and is there one hundred and twenty yards in width. The Missouri, for some miles above and below Linden Landing, varied in width from seven hundred to one thousand yards.

From this place to near the mouth of the "Big Sioux" may be said to be the most dangerous part of the river for navigation. I was informed that there had been several steamboats lost not far from Linden Landing.

The banks were low here, being destroyed by the current.

On the 2d of June we passed the mouth of the Platte. In uniting with the Missouri, it forms a delta, and debouches through three channels; the upper is about three hundred and fifty, the middle two hundred, and the lower channel thirty yards wide.

The delta is composed of sand-bars, which are covered with willow and cotton-wood. It is intersected by numberless sloughs. The valley of the river is about ten miles wide at its mouth, the bluffs which skirt the Missouri beginning to separate from that river and to extend themselves up the Platte, at points about five miles, above and below, from its mouth. As far as the eye could reach, in looking up the river, these bluffs could be seen bordering its valley, and within a short distance of the river. They are known to border the valley of the Platte, at distances from the river varying from a few feet to four miles, to points some distance beyond the fork. A few miles above this point, and between the north and south branches, a dividing ridge commences, and widening to the westward, has its northern and southern slopes to continue at the aforesaid distances respectively from the two forks of the river. Its top is very uneven, rising into mountains and peaks to the south, southwest, and west of Fort Laramie.

From its mouth to Fort Laramie the Platte is about seven hundred miles long, and is a less tortuous stream than the Missouri. To the fork its average width is about one mile. The north fork varies in width from three hundred yards to half a mile. The south fork is a little wider, and otherwise partakes more than the other of the character of the river below the confluence. Below the fork, the bed of the stream is occupied with vast quantities of drifting sand or quicksand, so that the average depth may not be more than three feet. The velocity of the Platte, during high water at Fort Laramie, has been found to be about six miles per hour. The difference of level between the mouth and that point is about three thousand five hundred feet, while between the mouth and Fort Union it is about one thousand feet. Thus it would appear that the Missouri falls one foot in a mile, and has a velocity of near five miles an hour, while the Platte falls five feet in a mile, and has a velocity of about six miles an hour.

Nearly all the wood to be found on the Platte grows on the numerous islands which occupy its channel; these are generally well timbered with cotton-wood and willow.

That river was low when we passed it, so that very little change was noticed in the appearance of the Missouri above the mouth of the Platte. I was told that in very high water the current of the Missouri appears, so to speak, *cut in two* by the rapid flow of the Platte.

With respect to the agricultural capabilities of the valley of this river, it may be said, in general terms, that the Pawnee Indians, who mostly live on its banks, find but little difficulty in cultivating the Indian corn; that at Fort Kearney, near Grand island, almost all kinds of vegetables, the Indian corn, and some other species of grain, can be produced with success; that from the mouth to the fork the valley abounds with the most nutritious grass, which will support stock in summer, and from which may be procured a great quantity of hay for winter use; and that, for the most part, what has been said as to the cultivation of vegetables and grain, and the growth of grass, will apply to Fort Laramie and vicinity. But all these advantages, I would judge, are less than they would be in other climates, for the reason that in the portion of country under consideration the vicissitudes of the summer season are great; hail-storms and high winds being of frequent occurrence, and the supply of rain irregular. I would here remark that most of what I have said concerning the Platte is founded on observations made during a journey I performed several years since to and from Fort Laramie.

From the information I have, I think I am justified in saying that the Platte cannot be availed of for purposes of navigation. The Missouri, near the mouth of the Platte, varies in width from five hundred to a thousand yards. From that point to the mouth of the Kansas its general course is south-southeast, and length two hundred and thirty-six miles.

The two ranges of hills which limit the valley of the Missouri continue, above the mouth of the Kansas, to be from seven to fifteen miles distant from each other, the eastern range touching the river at Parkville, Weston, St. Joseph and Elizabeth, after which it does not approach it until at Sergeant's hill; the western ranges at Fort Leavenworth and Independence prairie, after which it is within three-quarters of a mile of the river to a point five miles below the mouth of the Platte. These hills are from seventy-five to two hundred and fifty feet in height.

It has been remarked that at Fort Leavenworth, and for some miles above that point, both banks of the river are well wooded. The timber on the banks diminishes in quantity from that place to near the mouth of the Platte. Thence northward it may be said that, while the hills are thinly wooded with scrub oak, elm, and ash, and the immediate river banks skirted with a belt of cotton-wood and willow, varying in width from a few hundred yards to two miles, the space between this belt and the foot of the hills consists for the most part of prairies that are level and bare of timber.

What has been said with reference to the occurrence of ponds, sloughs, &c., in the river bottoms, applies to this section of the river, although, I think, not to the same extent as in the former case.

The carboniferous limestone and coal measures form the principal geological formation of this portion of the river.

There is a ferry at Platteville, below the mouth of the Platte, which connects with a road to the west.

It may be well to state here that above St. Joseph our steamboat ceased to travel at night, on account of the increased difficulties of the navigation. This necessity will, I think, be obviated when the dangerous obstructions are removed, and a more thorough knowledge of the river gained. It was found necessary to clean the boilers of the boat every second night, for the reason that, as she stopped every night, there was a great deal of sediment from the muddy water. Ordinarily, steamboats run from St. Louis to St. Joseph without having to stop for that purpose.

The next section of the river to be considered is that which is included between the mouth of the Platte and Fort Pierre.

The Missouri, from Fort Pierre to the mouth of the Big Sioux, pursues a southeasterly direction; and from the last-mentioned point to the mouth of the Platte it pursues a south-southeasterly direction. The length of this section is about six hundred and thirty-eight miles. The distances I have used are adopted from Nicollet's report, and are different from those in my former report to you, which were the distances as estimated by the captains and pilots on the Missouri.

We reached Bellevue at about seven o'clock on the evening of the 2d of June, and remained there all night.

Good coal has been found on both banks of the river near this place.

Council Bluff city, situated on the left bank, not far above Bellevue, is the last town seen in ascending the Missouri. It is the ordinary head of steamboat navigation. At present there are but about two steamboats which make regular voyages to Council Bluff city, and about twenty which trade between St. Louis and St. Joseph.

The river is open all the year as high as Boonville; above and to Council Bluff city there is sometimes about a month in winter when it is closed by ice.

On the 3d of June we passed a place called the Mormon Winter Quarters, which is a great rendezvous for the Mormons prior to their starting for the Great Salt lake.

There is a ferry here, as also at Bellevue and St. Mary's, Iowa. The road with which they connect leads up the Platte to the fork, and thence up the North fork, uniting with the main Oregon and California route near the Sweetwater, and not crossing the Platte at all.

Most of the wood now used on the boat was cut by the crew. She ran about a mile an hour faster than usual when using wood thus procured, as in that case the best quality was obtained.

Above Council Bluff city I observed many extensive tracts of dead trees standing, and which I thought must have been killed by fires. They were cut for fuel for the boat whenever practicable.

On the 4th of June we passed Old Council Bluffs, a place which was once occupied as a military post. We found the current very rapid at about four o'clock on this day; and, in attempting to proceed, broke part of the boat's machinery, which compelled us to halt for the night. We were obliged to stop alongside of a low prairie on the right bank, where there was nothing to afford a fastening. The flukes of several anchors had to be sunk in the ground in order to effect a mooring. While here, there was much to be dreaded in case of the occurrence of one of those terrible storms which sometimes sweep over this portion of country. At this place we were, for the first time since our departure from St. Louis, troubled with mosquitos. On the night of the 4th the boat was much shaken by the striking of large floating trees against it.

On the 5th we passed a forest on the left bank, which displayed in a very striking manner the ruinous effects of a Missouri river tornado. The largest trees had been torn asunder—some near their roots, some near their middle—and their trunks had been literally twisted, as if it had been done by a whirlwind.

The soil of the bottoms on this part of the river is very rich.

The Little Sioux river, which we passed on the 5th, is about sixty yards wide at its mouth, and is said to be navigable for small steamboats for ten miles to rapids, these being susceptible of improvement. It drains a country which has not many resources.

On the 6th we halted for wood at an island on the left bank, near which occurs the only settlement to be met with on the river between Council Bluff city and Sergeant's hill.

Just opposite is a spot called Pelican island, from the fact of its being a great resort for pelicans. We here first met with this species of fowl. The island received its name from Lewis and Clark, I believe, on account of their having noticed the same fact.

The settlement last mentioned is about eighty miles by land from Council Bluff city, and about forty-five miles from Sergeant's hill. In the afternoon we passed Wood's hill, where the bluffs on the right bank are close to the river for three-quarters of a mile. A rapid which occurs here is of about that length. The river was about four hundred yards wide at Wood's hill, while at the bend, which occurs where the hill above begins to diverge from the river, it was about half a mile wide.

We halted on the night of the 6th on the left bank, just opposite Blackbird's hill. This is about three hundred feet high, and is surmounted by a mound, which marks the spot where was buried the famous Omaha chief, Blackbird. We found the current very rapid near this hill. I noticed along here many avenues through the woods, each of which must have been formerly a channel of the river.

With reference to the changes which are always taking place in the Missouri, and which, being greater from near the Big Sioux to Independence prairie than on any other part of the river, make this the most dangerous section for navigation, I will quote here the observations I made at the time of performing the voyage: "Those changes which are constantly taking place in the bed of the Missouri, and in the direction of its channel, are well known. It would be very desirable to ascertain the general facts in relation to them, such as the periods of time within which they take place in a certain direction, the causes, &c., for upon these might be based the best plan for the improvement at some points of the river, or at any rate the knowledge might render the navigation much more safe than it is now. Besides, of what immense advantage would it be to settlers, who might thus know the portion of the numerous fertile spots open to their occupation not liable to destruction by the river. I have noticed, up to this day, many indications of these changes, in both directions, and it is probable they are constantly taking place at alternate points on the river, to the east and west at once, the destruction of the bank at any point succeeding, and being a consequence of that at a point above. And then, again, these supposed lines across the river are constantly shifting their position and direction, so that the difficulty of arriving at any general conclusions is manifest. I will mention one or two facts bearing on the subject: Lewis and Clark remarked that Blackbird's hill was the first point above Council Bluff where the hills of the right bank touched the river. At present it is Wood's hill. Nicollet mentions that the great bend opposite New Council Bluffs had disappeared subsequently to his voyage, and that the river, which then flowed at the foot of the bluffs, had removed several miles to the east of them; now the bend has reappeared, and the river having returned to the bluffs, has again commenced moving to the east." And, for aught I know, this change may have taken place more than once since Nicollet's voyage.

After passing several more rapids we reached Sergeant's hill. The spot is noted as the burial place of Sergeant Floyd, who died there during Lewis and Clark's exploration. Not far above is Floyd's river, a stream with clear water, well-wooded banks, and whose width was about forty-five yards.

After leaving the high bluffs on the left bank we passed the Big Sioux. It is about one hundred yards wide at its mouth, and navigable for steamboats to the rapids, and might be made so for a considerable distance by the expenditure of a small sum for its improvement.

Above the Sioux the current was so rapid that we were several hours in going a few miles.

The channel of the Missouri has, near here, changed within the last few years several miles from south to north.

Coming to another rapid near a prairie on the right bank, resort was made to the expedient, novel for a steamboat, of cordelling; the crew cordelled the boat for about half a mile.

On the 9th we were alongside of Hutan Kupey prairie, which extends up the river, on the left bank, from the Big Sioux to the Vermilion. On the right bank the bluffs were nearly all day close to the river.

Near Dixon's bluff commences the "cretaceous formation" described by Nicollet.

With reference to the phenomenon of the hills, emitting smoke as if their interior was burning, which sometimes takes place in this vicinity, I will quote here the observations of Mr. Nicollet: "I believe * * that these pseudo volcanic phenomena may be compared with those described as occurring in other portions of the globe, under the name of *terrains ardens;* although they are not here accompanied by the emission of flames. They are evidently due to the decomposition by the percolation of atmospheric waters to them, of beds of pyrites, which, reacting on the combustible materials, such as lignites, and other substances of a vegetable nature in their vicinity, give rise to spontaneous combustion; whilst further reactions (well understood by the chemist) upon the lime contained in the clay bed, produce the masses and crystals of selenite that are observed in the lower portions of this interesting deposit." I was informed that a hill was seen emitting smoke in 1852 about eight miles above the Vermilion.

The first lignite seen by us in ascending was on the left bank, not far above Vermilion river. From here it was occasionally met with as far as the mouth of the Poplar; but it was more fully developed between Fort Clark and Fort Berthold than elsewhere on the river.

Hills which appear to have been subjected to the influence of fire, either combustion in their interior, or the burning of the vegetable substances on their surface, are occasionally to be observed on both banks, from near Dixon's bluff to the mouth of the Poplar; but they are particularly to be noticed on the right bank for some miles below the "Great Bend." Their soil has an ashy appearance, and they are almost destitute of vegetation. They are called by the traders "Les cotes brulées." The crystals of selenite to be found on their slopes, reflecting very strongly the rays of the sun immediately after rainy weather, have caused them to be called the "Shining Hills." These crystals were found by us, in greater abundance than elsewhere, on the hills on the right bank below the mouth of White river. In the vicinity of the same place it was noticed that some of the streams were impregnated with alum. The Indians, I was informed, powder and use the crystals of selenite for whitening their bead work. In an analogous manner they avail themselves, for ornamental or useful purposes, of other minerals, and even of plants. They use the roots of some plants for medicines; and of others, as for instance the "pomme de prairie," they gather the pod, fruit or berry, to quench their thirst when unable to procure water.

Above I have departed somewhat from the main subject, the description of the Missouri below Fort Pierre, for the purpose of stating some characteristics which are common to this and the next section of the river. On the 10th we found the general appearance of the Missouri and its banks not very different from what it was on the 9th. I was informed that past experience shows the navigation is much easier above than below the mouth of the Vermilion.

We passed on the 10th the rivers Vermilion, Little Bow, and James. The first appeared to be about forty-five yards wide at its mouth; the James appeared only twenty yards wide, but is much more above the entrance; it is navigable for canoes, but it is not likely that it can be turned to a useful account as a navigable stream. It is important on account of its extent.

On the 11th, 12th, and 13th, the Missouri continued of nearly the same character as heretofore. The soil of the bottom was still rich, but was becoming less so as we ascended.

On the 13th we passed Bazil creek, the river L'eau qui Court, and Poucah creek. The first is about seventy-five yards wide at its mouth; the second, two hundred and fifty yards; and the third, forty yards. The L'eau qui Court takes its rise at a lake about thirty miles from Fort Laramie; it is, when high, navigable for canoes.

The preceding portion of this report was finished before I left Olympia.

In coming from that place to Washington, I lost, as you are aware, most of my notes of the survey of the Missouri.

What follows of the report is founded on such notes as I still have, consisting of the journal of Sergeant Collins, one of the members of the party; a copy, taken in Olympia, of the meteorological observations, and the original records of astronomical observations, and of collections made in the departments of natural history, geology, and botany. From these I think I can state all that is essential for the report. But I shall be unable to furnish you a map made as I have indicated; and I cannot state the depths of the channel of the river as found by the soundings we took above the mouth of the Big Sioux.

It has been remarked that, during a great part of our voyage, the river appeared tending to approach the western range of bluffs, leaving the greater part of the valley to the east of it. This remark will not apply above the mouth of the Vermilion; above which point also the bluffs began to become closer to each other. On the 13th we first observed cedar trees growing in small numbers on the banks of the river. As there was moonlight on the night of the 13th, we travelled until about 11 o'clock. On the 14th we halted at about half-after 5 o'clock in the afternoon at Cedar island for the purpose of procuring wood; we remained there all night. The island is about two miles long, and is covered with a thick growth of cedar, intermingled with cotton-wood; the soil is tolerably fertile; we found ripe strawberries in abundance. At about 8 o'clock all the party but Sergeant Collins crossed the river to the right bank, for the purpose of taking observations and making collections. We found the bluffs very high, and rising from the river somewhat in the form of steps. In going about a mile and a half from the river, we ascended a succession of hills, each higher than the last; and when we began to return, the bluffs to the west of us still continued to rise. The highest point we reached was about six hundred and seventy-six feet above the river. We returned to the boat at 2 o'clock on the 15th; we were much delayed until about 9 a. m. by sand-bars. Having passed White river on the 16th, and on the 17th the American, we came to the "Great Bend," a remarkable deflection, in which the river suddenly changes its course from east to northwest, then east, and then southwest. The boat halting at the foot of the "Great Bend," I sent a party across the neck of land, with directions to rejoin us when we should reach the opposite side. They collected some interesting fossils, and reported that the distance across was about two and a half miles; the distance around the bend was about twenty-five miles.

On the 18th, having passed Fort George, a trading post on the right bank, and an island, on which was a farm belonging to Chouteau & Co., we came in sight of Fort Pierre at 6 p. m. In approaching the post we took the channel to the west of an island, but found it impossible to pass a sand-bar near its head. Retracing our course, we ascended by the eastern channel, and when within about three miles of the fort a terrific storm compelled us to halt. We reached Fort Pierre at 7 a. m. on the 19th, and remained there until the morning of the 21st.

The Missouri, from the mouth of the Platte to Fort Pierre, varies in width from four hundred to one thousand yards. "Bon Homme" island, which we passed on the 12th, seems to be somewhat exempt from sudden changes, being nearly as I should suppose it was when described by Lewis and Clark.

I noticed eight rapids between the mouth of the Platte and Sergeant's hill, and thirteen between the last-mentioned point and the mouth of the Poplar. A chain of rocks extends across the river at a locality called the "Three Islands," and another at the foot of the "Great Bend."

On the 10th, 11th, 12th, 13th, 14th, and 18th, the boat was delayed by storms. She could not proceed with a strong side or head wind, but of course was aided in her progress by a wind from the rear.

On the 13th, 16th, 17th, and 18th, it was found very difficult to procure a sufficiency of fuel. Log houses, the remains of abandoned trading posts, were cut to pieces whenever met with, and furnished good, dry wood. Cedar was also much sought after; but neither kind of fuel was to be obtained in abundance.

The banks of the Missouri might be almost continuously settled as far up as the mouth of the L'eau qui Court. Above that point, I think about twenty-five per cent. of them possess that advantage. The land for some miles below Fort Pierre appeared to be more rich than that for some distance below the "Great Bend." In ascending from the mouth of the Platte to that point, the valley of the Missouri gradually becomes less fertile.

From the mouth of the Big Sioux to that of the White Earth the Missouri separates the Territory of Minnesota from the Indian territory. There is a road from Fort Pierre to Fort Laramie, which is about three hundred and thirty miles long.

The next and last portion of the river to be considered is that which is included between Fort Pierre and the mouth of the Poplar.

From the last-mentioned point to Fort Union the Missouri pursues a direction a little south of east, and thence to the mouth of White Earth, a little north of east.

The latitudes of these three points are respectively about 48° 05′ 48″, and 48° 07′ 30″. Without all my notes I am unable to state precisely at what point the Missouri attains its highest north latitude, but I think it is near the mouth of the Great Muddy.

From the mouth of the White Earth to Fort Clark, the direction of the Missouri is southeast, and thence to Fort Pierre it is south. The length of this section is about 715 miles.

Above Fort Union the river varies in width from one hundred and fifty to three hundred yards; at that point it has been found, by pacing on the ice in winter, to be three hundred paces wide; and from Fort Union to Fort Pierre it varies in width from three hundred paces to eight hundred yards. I would remark that my statements of the general width of the river are merely estimates, as I had very few opportunities to make measurements.

Not far north of Fort Pierre a second "great bend" occurs, of which the distance across is about eight miles; that around about twenty-five miles; its apex is towards the west. A third "great bend" is found not far north of Fort Berthold, of which the distance across is about twelve miles; that around about forty miles, and having its apex towards the southwest. These are distinct from that general change of direction in which the Missouri, after flowing from the southwest, runs near the 48th parallel to the mouth of the White Earth, and then suddenly turns to the south-southeast and south. This is called the "Great Northern Bend of the Missouri."

Besides this river, the great features of this region are the Yellowstone, which takes its rise in the Rocky mountains not far from the headwaters of the Missouri; the Black Hills, which, starting from the Platte not far above Fort Laramie, pursue a north-northeasterly direction parallel to the Little Missouri, and finally become blended with the bluffs of the Missouri east of Fort Union; and the Grand Coteau or ridge, which, running nearly parallel to the Missouri at an average distance of about forty miles, connects, according to my information, with the Rocky mountains north of the 49th parallel, and divides the waters of the Missouri from those of the Suskatchawan, from those of the Red river of the North, and from those of the Mississippi. I think it unquestionable that only in a far-distant future will any great extent of this country be inhabited by white people. The valleys of the streams alone seem now to present inducements. The hills and ridges are generally covered with a nutritious grass, more sought after by cattle than that in the valleys. The great variety of flowered plants to be met with gives a degree of beauty to the undulating plains.

The following is a general statement of the ease of navigation of the Missouri above Fort Pierre. As far as the mouth of the White Earth the obstructions are comparatively few, and the navigation safe; although the main fact on which I state this, the ease and speed with which we passed over that portion of the river, is partly due to the light draught, three and a half feet, of the steamboat above Fort Pierre. Above the mouth of the White Earth the river has an exceedingly tortuous course, and is impeded by an unusual number of sand-bars, snags, &c. In addition to which, above Fort Union it becomes much more narrow, and is very rapid at all bends, many of which, instead of being curves, are nearly in the form of a right angle. It was in this part of the river that it was noticed nearly every tributary corresponded to an island in the Missouri near its mouth—sometimes below, sometimes above. This is, perhaps, due in part to the difference in velocity of the streams.

The "cretaceous formation" continues for some distance above Fort Pierre, and is succeeded by the formation of clay and marl containing beds of lignite, which continue to the mouth of the Poplar. As the water of the Missouri at Fort Benton is clear, and as from the Poplar to the Mississippi it has a deep muddy color, this, it seems to me, must be imparted by the flow through the clay and marl formation.

We left Fort Pierre early on the morning of the 21st. The bluffs at this place are about four miles from each other, and equally distant from the river. During the day I noted many points that were suitable for settlements; they had a tolerably rich soil and produced fine grass. The river in many places was well timbered with cotton-wood, intermingled with which was a small quantity of ash. Cedars were observed in small numbers in the ravines. Many tracts of dead trees standing were seen on the "Burnt Hills" along here; there were noticed indications of "slides," and of the earth having caved in, probably on account of combustion in the interior.

On the 22d, the river was wide and not very rapid. We had to halt early in the afternoon on account of a high wind.

On the 23d, the character of the river and country was not materially different from what it was observed to be on the 22d.

On the 24th, it was found difficult to procure a sufficiency of fuel. In the afternoon we passed the "Grindstone Buttes"—a singular group of hills, whose sides slope from the prairie at angles of from 30° to 45°. They were covered with grass, but no trees were observed to grow on them. Of a great extent of this portion of the river, both below the mouth of the White Earth and above Fort Union, it may be remarked that, outside of the river bluffs, there are plains or terraces several miles wide, and from which rise other ranges of hills or bluffs. For some distance above the "Grindstone Buttes," it is characteristic that many similar hills, or groups of hills, occur on those plains or terraces. In shape they are sometimes conical or truncated, sometimes dome-shaped, and occasionally have the form of ridges.

The steamboat did not halt on the night of the 24th.

On the 25th, the land appeared richer than on the 24th. The hills, it was observed, were not as high nor so irregular, and produced better grass. Very little or no lignite was seen. The "Burnt Hills" almost entirely disappeared. The bottoms were wide and well wooded. Besides the cotton-wood, there were noticed the ash, elm, willow, and in the ravines the cedar, all of which were small in size except the cotton-wood.

On the 26th, the river was narrow, tortuous, and swift. Being high, it had in several places overflowed the wide bottoms at the bends. In the afternoon we noticed, at some distance from the river, high hills shaped somewhat like a sugar-loaf, and which were entirely bare of vegetation. The great number of grasshoppers that we saw in this portion of country was remarkable. At one point they might be said literally almost to cover the ground. By their motion in the grass, they made quite a loud noise. I was informed that often they frustrate the attempts at cultivation made by the Indians, and at the trading-posts.

On the 27th, we passed the "Square Buttes," which rise from the plain at angles of about 45°. They are truncated, and average about three hundred and fifty feet high. In the afternoon we were compelled to halt, on account of a high wind. During the night it was very cool, and the wind blew furiously from the northwest.

On the 28th, we did not travel on account of the storm. The day was so cool that at noon the thermometer stood at 54° above zero. There were several pieces of ice seen floating down the river. I was furnished with the following explanation of this fact: In winter, the river being frozen, the ice occasionally breaks up at some points, as between Fort Union and Fort Benton, in consequence of which an accumulation takes place at points below, where the same "breaking up" does not occur. Some fragments of this ice are thrown ashore, and perhaps by high winds become subsequently covered with sand. In this way they are preserved from melting, and when the river rises in June are carried down the stream.

We reached Fort Clark early on the morning of the 29th. The Indians at this place cultivate, with tolerable success, corn and some vegetables. The country for some distance above this post may be thus described: While on the left bank there were wide bottoms and extensive prairies producing fine grass, on the right were bluffs one hundred and fifty or two hundred feet high, and nearly vertical, containing lignite and red clay, and having near them a number of hillocks bare of vegetation, and in shape somewhat resembling a sugar-loaf. The "Burnt Hills" reappeared in some places.

We reached Fort Berthold at 1 o'clock on the 30th. The Indians here cultivate the land to some extent. In the vicinity of this post, as well as above Fort Union, it is characteristic that many ranges of nearly vertical bluffs, one hundred and fifty to three hundred feet high, and bare of vegetation, occur, rising from the plains or terraces of which mention has been made. By the variety of colors imparted to them by the red clay, lignite, and a white substance they contain, they present a picturesque appearance. The white is sometimes the color of a rocky stratum, and sometimes it is from a mere incrustation. These bluffs occasionally run parallel to the river, but generally make an acute angle with its course. They sometimes have quaint forms, reminding one of the appearance which old towns or castles have when seen in the distance. They are often called by the traders "les mauvaises terres," on account of the species of quagmire they contain. These are depressions filled with clay, which is covered with a white incrustation, giving the surface the appearance of being firm.

On the 1st of July we passed the mouths of the Little Missouri and White Earth rivers. The extent of the forests of dead trees to be seen near the latter stream is remarkable.

On the morning of the 2d the river was overhung by a dense fog.

We passed Fort William and the mouth of the Yellowstone in the afternoon of the third. The water of this stream had a deep muddy color, like that of the Missouri. It was about four hundred yards wide at its mouth, but this contained a large sand-bar. I was informed that the Yellowstone might be navigable for two hundred miles to rapids, these being susceptible of improvement, and beyond which no obstruction would occur for a considerable distance. If this were found by future examination to be correct, that river might become the means of communication, by steamboats, with a large area of country; more particularly if it be supposed that favorable routes exist from the head of that navigation to Fort Laramie, Fort Hall, and the Salt lake, and to the valley of the Bitter Root river.

A short distance below Fort Union the Missouri appeared, so to speak, entirely choked by sand-bars. For two or three hours the channel could not be found. But finally we proceeded by a narrow and deep slough, between a sand-bar and the left bank. We reached Fort Union at about seven p. m.

The fourth was employed in unloading the boat of such freight as was not to go to Fort Benton. Her draught above Fort Union was about two feet. The Fur Company has a farm about eight miles below this post. Not much success has attended the attempts at cultivation. The grasshoppers are a source of much injury to the crops. On the morning of the fifth we proceeded, with the intention of going as far as the mouth of Milk river. I left all the party at Fort Union except Sergeant Collins and private Wilson, of the sappers. The river was averaged about two hundred yards wide, and was not unfavorable for navigation. The channel was about seven feet deep, the river being nearly six feet below high-water mark. The current was not very rapid. The Missouri generally flowed through a narrow bottom, with bare, rugged, clay bluffs on each side.

I would remark here that, during our ascent to Fort Clark, the river was generally rising at the rate of from two to seven inches during a night.

At one point above Fort Union I noticed that the soil was rich, and somewhat resembled that in the State of Missouri. Some idea may be formed of the retentive nature of the soil above that post from the statement of the following fact: Directly after a profuse rain, and when the rivulets were swollen, the rain-water was, for some distance, observed falling from the bank into the river in an unbroken sheet.

On the sixth we passed, in the afternoon, the mouth of the Poplar, a clear stream about sixty yards wide at its mouth. Just opposite was the dry bed of a stream about eighty yards wide, and now called "Little Dry" creek. It was, I believe, named by Lewis and Clark "Two Thousand Miles" creek. Several extensive prairies are seen in this vicinity, particularly on the right bank, which produced nothing but wild sage.

About seven miles above the mouth of the Poplar, there were encountered difficulties from sand-bars similar to those met with at Fort Union. I think they could have been overcome. But the managers of the boat thought best to return from this point. They accordingly had carried ashore the Fort Benton freight, which was to be conveyed to that post by cordelling a large keel-boat. We returned to Fort Union on the ninth. No material obstructions were met with in our descent. The steamboat travelled with nearly three times the speed she did when ascending.

We had an opportunity of verifying the survey of this portion of the river. It was found that the courses and features of the country were pretty accurately laid down, while the estimates of distances were somewhat erroneous. Wood appeared to be more abundant from Fort Berthold to the mouth of the Poplar than on any part of the river above the mouth of the Platte. I noted several different kinds of cotton-wood and willow. In travelling over so extensive a region from south to north, it was to be expected that changes would take place in the growth. I believe most of the trees which grow in southern latitudes disappear from the banks of the river south of the northern boundary of Missouri. The last sycamores to be seen in ascending were, I was informed, at the first bend above the "Mormon Winter Quarters." In high water, the greater part of the banks of the Missouri may be thus described: They are from two to twenty feet high, vertical, and, in horizontal projection, would be zigzag lines, in consequence of the earth continually falling into the water at numerous points. In low water, I was informed, these banks often have at their base a pebbly or rocky beach, inclining to the water's edge, and being from ten to forty feet wide.

After the Yellowstone, the principal tributaries of the upper portion of the river are the Moreau, the Cannon Ball, and the Shayenne; they are only navigable for canoes or buffalo-boats.

The following general facts were principally furnished me by persons who appeared to be well acquainted with the Missouri:

However difficult to find it, there is always a good channel in the river. In consequence of the diminished effects of the current, the channel, though not so deep, is less changeable, and more safe for navigation by steamboats of light draught in low than in high water.

As steamboats descending the river proceed with nearly treble the speed they would have in ascending, they find in sand-bars a much more formidable obstacle in the former than in the latter case; it is often necessary to unload in part before they can be relieved after encountering the bar in descending.

Along that portion of the river where it flows through the great prairies, the frequency of storms, generally from the northwest, is a very serious impediment to the navigation. This was found to be true during the voyage of our steamboat, except that the storms were not generally from the northwest.

The Missouri is affected by two annual floods, which greatly facilitate navigation by the larger steamboats. The first and lesser flood is caused by the melting of the snows on the prairies, and generally takes place in May; the second arises from the melting of the mountain snows, and occurs in June. Steamboats, heavily freighted, and bound for the Yellowstone, should leave St. Louis about the middle of April, in order to have the full benefit of the June rise. The river above Council Bluff city is closed by ice from about the middle of November to the first of April.

It is thought that steamboats could, were it not for the ice, ascend to the mouth of Milk river throughout the year; this being the highest point to which the navigation has heretofore been carried.

I believe the voyage of the "Robert Campbell" in 1853, forty-two days ascending to Fort Union, and about seventeen days descending thence to St. Louis, may be taken as an average trip. But it appears to me that there exist almost certain means of reducing the time of ascent at least one-third, and possibly one-half. The same steamboat can easily perform in one season two trips to Fort Union and back.

With reference to the improvements that might be made of the Missouri, my information was not of the character to enable me to estimate their cost, or to say where or in what manner they should be applied. For that purpose a more detailed survey should be made, and the person having charge of such should become acquainted with every portion of the river at all stages and seasons.

It occurs to me that it would be highly advantageous to adopt some system for maintaining a knowledge of the river at all points; and for this purpose, to establish posts of observation, at which competent persons should ascertain and keep an account of all information bearing on the subject of the navigation. A telegraph along the banks of the river, besides being valuable in other respects, would, it seems to me, be very useful for the transmission of that information from post to post; and steamboats in passing could thus communicate, for the benefit of those behind them, the state of the river above or below the posts of observation. Most of the obstructions in this river, I think, are of such a character that it will be necessary to remove them every two or three years. An engineer, or board of engineers, should be appointed, whose duty should consist in reporting, from time to time, to the people, merchants, or State legislatures interested, or to Congress, what obstructions should be removed; furnishing estimates, and stating in what manner the work should be done, as well as in superintending all arrangements made to facilitate the navigation.

Any system which might be adopted should, of course, bear a proper relation to the importance of the objects to be attained, and to the interests concerned.

If I am not mistaken, the merchants in some of our large seaport towns have systems analogous to the above for securing the safety of their vessels and goods.

By the adoption of some such arrangement as I have mentioned, it appears to me that the prosperity of the Missouri might be greatly enhanced, and its importance developed as part of a line of communication from the heart of the Mississippi to that of the Columbia, and to Puget sound. In your instructions to me, you remarked that the principal object of the survey of the Missouri was to ascertain the reliance to be placed upon it for the transportation of supplies for the construction of the proposed northern Pacific railroad. The extent to which it may be relied upon may be judged of by combining with what is known of it the prices of labor and supplies at its lower depot or depots, and then comparing it with the other means of transportation which are likely to come into competition: these are, transportation from the Mississippi by wagons, and that from the same by the railroad itself. Into this discussion or comparison it is not my province to enter.

Your instructions required me to report as to the kind of steamboat which should be used for a future detailed survey of the river. I came to the conclusion that it should be a high-pressure western river steamboat, of as light draught as practicable, so made as to obey very quickly the rudder, and equipped with powerful engines. The upper wood-work should have as little elevation above the hull as would be consistent with convenience and with the space required for the machinery. I almost inclined to the opinion that the usual second story should be dispensed with, if it were found possible to place elsewhere the cabin accommodations.

In concluding the report upon the Missouri, I have to express my regret at the incompleteness of the survey. The members of the party of which I had charge were but passengers on the steamboat, who made the best use of the time and facilities at their command to fulfil the duties indicated in your orders.

Your instructions required that, on arriving at Fort Union, I should reconnoitre the country in the vicinity of that post.

Preparations were accordingly made on the 9th, 10th, and 11th of July, by procuring the necessary horses and saddles, preparing a wagon, &c. The party consisted, besides myself, of Lieutenant Mullan, Mr. Graham, five of the sappers, and four employés. One of the sappers, artificer White, I left at the fort, to keep up a series of meteorological observations, and to take care of the provisions and other stores in depot for the use of the survey.

We started on the morning of the 12th, travelled nearly north-northwest to a point about opposite the head of the Big Muddy; then nearly north-northeast to the Grand Coteau and a point near the head of the White Earth; then nearly south-southeast until we struck that stream; then down it for some miles, and then back to Fort Union; the entire distance travelled being two hundred and thirty-five miles. We had no barometer.

The following is a general description of the country passed over:

The country between the Big Muddy and White Earth rivers may be characterized as being a vast plain, destitute of timber, and covered with boulders and pebbles of granite, mountain limestone, &c., broken towards the north by innumerable hillocks, the depressions between which are occupied by ponds and lakes, and intersected towards the south by valleys, through which flow the tributaries of the Missouri.

The smaller of these streams, and the Big Muddy, take their rise south of the parallel of 48° 38′, while the Miry and White Earth have theirs not far from the foot of the Grand Coteau.

The summit of this range, where we struck it, was in latitude 48° 45′ 46″, and its general direction was, as I had been informed, a little to the north of west. When we were about six miles to the south of the Coteau, it appeared like a "distant shore," which sloped at an angle of about 30°, and whose height was about one hundred feet; but the ascent of it was so gradual, that when we were passing from the foot to the summit, we could not perceive that we were ascending.

All the streams which have been mentioned are very small, and can never be of any value for navigation. They are liable, particularly the White Earth, to very high freshets.

Connecting with the bluffs which limit the valley of the Missouri at Fort Union is a low ridge, which pursues a north-northwesterly course to about the parallel of 48° 38′, and thence runs to the northeast, and becomes merged into the Grand Coteau.

This ridge divides the waters which flow into the Missouri above Fort Union from those which enter below. Where it turns to the northeast, there is a wide valley, through which flows a small stream connecting a series of ponds, marshes, and lake. This valley, from having been parallel to the ridge, turns to the west and continues in a direction towards the Big Muddy river.

About thirty-two miles north-northwest of Fort Union is a chain of sand-hills, covered with a thick growth of small willow. These very much resemble what are called "moraines." I noticed near the head of the Miry river an extensive outcrop of lignite, similar to that seen on the Missouri.

I have to transmit herewith an itinerary of the country we passed over, a copy of the meteorological observations, and a profile of the Missouri.

The map which I wish to accompany this report is principally made up of Nicollet's map below Fort Pierre, and of Lewis and Clark's above that point, with some of our own observations added to them.

Of the collections made by the party on the Missouri and in the vicinity of Fort Union, those in the department of geology were directed to Dr. Evans, and sent to St. Louis, and those in the departments of natural history and botany to Professor Baird, and sent to Washington.

I am, sir, very respectfully, your most obedient servant,

A. J. DONELSON,
Second Lieutenant of Engineers.

Gov. Isaac I. Stevens,
Chief of the Northern Pacific Railroad Survey.

15. REPORT OF LIEUTENANT C. GROVER, U. S. A., OF HIS SURVEY OF THE UPPER MISSOURI, FROM THE GREAT FALLS TO CONNECT WITH THE SURVEY OF LIEUTENANT DONELSON.

Sir: I have the honor to submit the following as results of my survey of a portion of the Missouri river, made pursuant to your directions, in the latter part of September and the first part of October, 1853.

The Missouri, from the Great Falls to near the mouth of the Muscle Shell, is a clear, rapid stream, of no great depth, and with a gravel bottom. Its general width, which for some miles below the falls is about two hundred yards, gradually increases as it flows on receiving its tributaries. As to its channel, it is quite variable, and its course is checked by many bars of gravel across its bed, causing rapids. At present I shall notice only those of the most importance as limiting the height to which boats can ascend, and the draught to which they must be confined to make the ascent. From the falls a succession of wild and impassable rapids extend some ten miles down, when they become less frequent, to the mouth of the High Wood creek, a small tributary which empties itself into the river on the right-hand side, and about fifteen miles below the falls.

Immediately below the mouth of this tributary the river assumes the character which it retains as long as it flows over a gravelly bottom. The next rapid of importance is one that becomes so from the shallowness of the water, there being only fifteen inches on the bar. This rapid is about five miles below Fort Benton. Immediately above the site of the old Fort McKey another rapid occurs, twenty inches water on the bar; and one opposite Burnt island, about twelve miles below Fort Benton, with twenty-two inches on the bar. There is no other obstacle upon either of these bars than want of water. A rapid known as "Publicus," a few miles below, had twenty-three inches of water on the bar, but a clear channel. Another without a name, a few miles below this again, had two feet on the bar, but this season had several large rocks near the channel. But the worst point in the whole river, with the exception perhaps of the one first mentioned, is one which goes by the name of "Dauphine's" rapid, about sixteen miles below the mouth of Dry river. Here a gravel bar extends across the whole river, and a small gravel island near the middle divides the stream into two branches, of nearly the same depth, and causes a bend in the channel of both; in addition to this, boulders of a ton weight are frequently found in and near the channel. The depth of water in the channel was twenty inches; its rate did not exceed four and a half miles per hour. The current is stronger here than at any other point on the river. There were several other rapids below this, but of no consequence as compared to it. From this point, which is about sixty miles above the mouth of the Muscle Shell, the river-sand begins to alternate with the gravel of the bottom, and the rapids and shallows become less frequent and the channel better; and, as we approach the mouth of the Muscle Shell, the river begins to assume the characteristic appearance of the Missouri in every respect; and below its mouth all obstacles to navigation for small boats may be considered at an end. Its width gradually increases, and near the mouth of the Milk river its general width is about four hundred yards.

The above statements refer to the river between the 20th and 30th September. Earlier in the season, when its tributaries are supplied from the melting of the snows in the mountains, its depth is much greater. In the month of June it has about three feet more water; from the first of August to the middle of September it falls very gradually, and upon the first of September the depth is about one foot greater. This rise and fall of the river is very regular, and it is but little affected by accidents of weather. During the high water the current is very rapid and severe, and the small rapids are lost sight of. As to the large rocks sometimes found in the channel, they are brought from high up the river by the ice as it goes out when the river breaks up. During the winter they become attached to the under surface of the ice, and in its removal they are taken along till they are rubbed off by some gravel bar or fall down by the melting of the ice; the next season, if on a bar and near the surface, they again become frozen up with the ice and are moved farther down. Thus they are constantly working their way down the river, and a bar that this season is encumbered by them may be free the next.

Conclusions with regard to Navigation.

From the above statements it will be seen that the only obstructions to the navigation of the river by steamboats are the shallowness of the water and the large boulders in the channel. But the first does not exist as an obstruction to boats drawing twenty inches, before the middle of September. As to the second obstruction, it can, I think, be obviated by providing a boat with suitable grappling-hooks, with which she can hitch on to a rock in her way, and drop down with it to deeper water, with but very little detention. A boat drawing twenty inches, loaded, can then, I think, navigate the river from the opening of the season till the first of September with perfect safety. Earlier in the season it is quite probable that boats of three feet draught would find no difficulty in ascending, but, in order to be here in time, they would have to winter at Fort Union. This fact, therefore, becomes of no practical advantage at present. As to wood for the use of boats, plenty of it can be found upon the banks.

A steamer of eighteen inches draught could, in my opinion, ascend the river at any time.

C. GROVER,
Second Lieutenant Fourth Artillery.

Governor I. I. STEVENS.

P. S.—On the lower portion of the river, as above referred to, there are many quite extensive bottoms well adapted to agricultural purposes. There is a good deal of arable land, also, in the vicinity of Fort Benton and in the Sun River valley. A more extensive note will be made upon this, under the head of Topography, in my final report.

C. G.

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16. REPORT OF LIEUTENANT R. SAXTON, U. S. A., OF HIS TRIP IN A KEEL-BOAT FROM FORT BENTON TO FORT LEAVENWORTH, AND OF THE NAVIGABILITY OF THE MISSOURI RIVER BY STEAMERS.

WASHINGTON, D. C., *June* 8, 1854.

SIR: I have the honor to submit the following report of my journey down the Missouri. I left Fort Benton on the 22d of September, 1853, for St. Louis. My party consisted of Mr. Culbertson, Indian agent among the Blackfeet; Mr. Graham; Mr. Hoyt; Sergeant Collins, of the sapper and miner company; a detachment of seventeen dragoons from company I, 1st dragoons, and six quartermaster's employés.

I was charged with the duty of returning the soldiers and employés of the Quartermaster's department to St. Louis, and gathering such general facts as I could with regard to the capability of these upper waters of the great Missouri for steamboat navigation.

I started at the driest season of the year, when the Missouri was uncommonly low, and had, therefore, an opportunity of observing the river in its most unfavorable state. During a great portion of the year, the rains and melting snow in the mountains swell the volume of water to many times its size at the low stages, making the passage of boats much easier.

I embarked upon a keel-boat obtained from the American Fur Company, and built by them of timber brought from the Rocky mountains. It was eighty feet long by fourteen wide, had twelve oars, and drew, when loaded, eighteen inches of water. We called it the "Blackfoot," from the fact of its being probably the first boat ever constructed in that wild region. The fact that a journey of more than 2,000 miles was made in so unwieldy a craft, indifferently manned, after the 18th of September, is in itself an evidence in favor of the supposition that steamboats can operate with advantage.

For the first two days of my journey the water of the river was comparatively clear, with a gravel bottom; the channel crooked, the current varying in swiftness between one-half and four miles per hour. In no case did I find less than fifteen inches of water upon the bars, and so shallow a run as this in but one or two localities.

Owing to the peculiar nature of the bottom—it being a mixture in many places of quicksand and fine gravel—it would give way very readily to the action of the paddle-wheels, and admit of the passage of a boat drawing a greater amount of water than is actually found upon the bars.

The regimen of the river above the mouth of Muscle Shell is fixed. The banks change very little, and there is very little timber. Should steamers run here eventually, there will be a scarcity of fuel; enough, however, can be collected for present purposes.

The "Mauvaises Terres" lie directly above the Muscle Shell; through these the channel is very good. The worst bar in the river is above the Bad Lands, a few miles below Fort Benton, where there was but fifteen inches of water.

From the Muscle Shell downward towards the mouth of the Yellowstone the river changes. The water gradually becomes muddy from the washing away of the banks; the channel is constantly shifting its position; the forests of cotton-wood, with which the banks are lined, falling into the river, causes numerous snags and sawyers. Below the Yellowstone, the Missouri assumes the same character it maintains to its mouth. It becomes thick and muddy with the alluvial deposit it is ceaselessly bearing onward to the Gulf of Mexico. The bed of the river is much broader; the waters separate into many different channels, forming numerous sand-islands, sometimes covered with forests of cotton-wood.

This subdivision of the waters forms one of the most serious obstacles to the navigation of the river. It requires great care and experience to keep in the main channel, for, if it is once lost, one becomes involved in difficulty. I found that in every instance there was always a main channel containing a sufficient depth of water. I arrived at Fort Leavenworth on the 9th of November, having sailed a distance of more than 2,000 miles since the 22d of September. I was detained about one-third of the time by the high winds which prevail on the Missouri in the autumn, and prevented from travelling at night by the numerous snags found in the channel.

The difficulties I had to contend with in my journey were principally high winds, snags, sand-bars, and a crooked channel. A wind which would not affect a steamer sensibly, would render the "Blackfoot" completely unmanageable; and from the little power I had in comparison to the size of my boat, I found it extremely difficult to make the sharp turns in the channel.

I have no hesitation in expressing an opinion, founded upon actual observation and experience in the navigation of shallow rivers of a similar character, that a steamer properly constructed, drawing two feet of water, can at all seasons, when the river is not frozen, ascend as far as Fort Union, and that one drawing twenty inches can go up beyond Fort Benton.

The kind of steamer best adapted to the service is a matter to be carefully considered. In many places the river is so much obstructed by snags as hardly to leave a passage-way for a boat: in such cases the stern-wheel steamer would have the advantage; but in crossing bars and making short turns, which is so often necessary, as well to follow the channel as to avoid snags, side-wheels would be much preferable. I am of the opinion that a side-wheel steamer, built as strong and narrow as possible in proportion to its length, and drawing twenty inches of water, would be the best one that could be used.

It is unnecessary to point out depots for wood; the voyager has but to land anywhere on the river and plant his axe into the fine cotton-wood forests with which this magnificent stream is lined. The supply is inexhaustible. As accurate surveys of the river have been made by Lieutenants Grover and Donelson, I have only given, in this brief report of my journey, the results of my own observations with reference to the navigation at a low stage of the water. I have omitted, also, all the incidents of my voyage, which were interesting and varied. We had many adventures with Indians little accustomed to meeting with their white brothers; and the tediousness of the otherwise monotonous voyage was relieved by many an exciting chase after the buffalo and other wild animals with which this country abounds.

I am confident that enough has been presented to prove that this great river can be navigated by steamboats for a distance far exceeding that of any other, and that their whistle will soon be heralding the advance of civilization into the heart of the Blackfoot nation.

I am, very respectfully, your obedient servant,

R. SAXTON,
Lieutenant Fourth Artillery.

Governor I. I. Stevens,
Washington, D. C.

F.

SURVEYS FROM THE EASTERN BASE OF THE MOUNTAINS TO THE LOWER COLUMBIA.

17. REPORT OF THE ROUTE OF LIEUTENANT R. SAXTON, U. S. A., FROM THE COLUMBIA VALLEY TO FORT OWEN, AND THENCE TO FORT BENTON.

WASHINGTON, D. C., *February*, 1854.

SIR: In obedience to your instructions of April, 1853, appointing me acting assistant quartermaster and commissary for the expedition under your command, for the exploration and survey of a route for a railroad from some point on the Mississippi river to Puget sound, and directing me to proceed by the way of the Isthmus of Panama to Columbia barracks, in Washington Territory, and there organize a supply train, and establish a depot of provisions at the Flathead Indian village of St. Mary's, and join you at Fort Benton, proceeding thither by the Blackfoot Pass of the Rocky mountains, I have the honor to submit the following report of my operations in the performance of that duty.

As incidental to the establishment of a depot of provisions for the use of the main parties engaged in the exploration, I was directed to make such observations with reference to the topography of the country through which I should pass, and the facilities or difficulties it presented to the construction of a railroad, as would not interfere with the main object of my expedition.

The distances stated in the report are only approximations inferred from the pace of a horse, and the directions were determined by the bearings of a pocket compass. They will, however, I trust, give a tolerable, if imperfect, idea of the country through which I passed.

I left New York on the 5th of May, and proceeded, by the way of the Isthmus of Panama, to San Francisco, California, where I arrived on the 1st of June. It being necessary to procure most of the articles required for the use of the expedition at this place, my arrival in Washington Territory was delayed until June 27th. The abundance of gold in California, and the consequent high price of labor, made it very difficult to procure men for the expedition, even at the highest rates. But for the assistance afforded by the agents of the Hudson's Bay Company, I should have been unable to organize a party at all. I applied to Governor P. Ogden, the chief factor of the company, for aid, which he very readily granted. It is worthy of remark, however little flattering to American pride, that the power and influence of that company over the inhabitants of the country which I traversed is greater than that of the government of the United States. Even the Quartermaster's department is obliged to depend upon them for the transportation of troops and army supplies.

On the 2d of July, Lieutenant Arnold, 3d artillery, who had volunteered for the expedition, started up the Columbia river with the greater part of the stores destined for the Flathead village, and twenty-one men employed as packers. In consequence of high water in the river, the passage of the Cascades was exceedingly difficult, and it was necessary to transport all our baggage for a considerable distance on the backs of men. Lieutenant Arnold, with characteristic energy, succeeded, after a week's hard labor, in landing his stores at the Dalles of the Columbia. I completed all the arrangements for the expedition, and with the soldiers detailed as an escort, and the remaining commissary stores, arrived at the Dalles on the 14th of July. As all the animals in the possession of the Quartermaster's department at Fort Vancouver were required by Captain McClellan's party, we were obliged to depend, in a great measure, upon the Indians for our horses. Reports were in circulation that we were fitting out a war party against them, and they showed great unwillingness to bring in horses. Every aid in their power was promptly rendered by the officers at Fort Vancouver, and the Dalles, to forward the interests of the expedition.

Extracts from my journal kept on the route will give you the most complete information concerning my operations from that point.

Monday, July 18, 1853.—We have completed all our arrangements, and started for the Rocky mountains at four o'clock p. m. Our animals being wild, and unused to carrying packs, we had great difficulty in getting under way, and only marched five miles, with the loss of several packs. The party is now composed of Lieutenant Arnold, 3d artillery, Lieutenant Macfeely, 4th infantry, Mr. D. L. Arnold, an escort of eighteen soldiers, Mr. D. S. Hoyt, one packmaster, one assistant packmaster, twenty-three packers, three herders, two cooks, and one guide. As it is rumored that the Indians on some parts of the route are hostile, in order to guard against surprise, the party march in the following order, which is to be observed throughout the journey: 1, guide; 2, Lieutenant Macfeely, with one-half the soldiers; 3, the pack train, each packer having charge of five animals, that being the greatest number which one man can manage in the wild mountain region through which we are to pass; 4, the remainder of the escort of soldiers in charge of the sergeant. We are encamped on a small creek, five miles from the Dalles, in good grass. From this point nearly to Wallah-Wallah we shall follow the emigrant trail, so that a particular description of the country will be unnecessary.

Tuesday, July 19.—Commenced at daylight preparations for marching; but our animals continued to rebel against their unwonted burdens, so that it was late before we got under way. We encamped at Olney's ranch, six miles from our last night's camp.

Wednesday, July 20.—Marched eight miles, to Sand Camp, on the Columbia, five miles from Camp Olney. We came to the Des Chutes river, a branch of the Columbia from the south, a swift, rocky stream, too deep to be forded, and abounding with fine salmon and trout. A ferry is kept here by an American, and supported principally by the emigrants. It was late before all the animals and baggage were got across. Our camp is in a pleasant spot, with abundance of good grass. We were much annoyed by sand, the wind drifting clouds of it over our tents and beds. We purchased abundance of salmon from the Indians.

Thursday, July 21.—We are encamped, this evening, on a rocky creek, a small branch of John Day's river, a tributary of the Columbia. Our route had been along the Columbia, some eight or ten miles distant. Some elevations of a thousand feet above the river were passed. We were all day in sight of Mount Adams and Mount Hood, whose snow-capped summits rise into the region of perpetual frost, fifteen thousand feet above the ocean level. These mountains present a grand and sublime appearance, and are peculiar objects of Indian superstition and tradition, the special abodes of the "Great Spirit" and of genii of various names and functions.

We have had an uncomfortable march across a heath entirely destitute of water and trees. The thermometer ranged as high as 106° in the shade. Our animals were much broken down, and when they reached the camp, parched with thirst, they plunged into the deep cool water of the river, and thus many articles of provisions were more or less injured. I found additional difficulty to-day from the indifferent pack-saddles procured at San Francisco, the materials of which are very weak, and ill put together, so that they injure the backs of the animals. Far as we are from the means of procuring or constructing others, this is a serious inconvenience.

Just before reaching camp, we had the misfortune to break down our only wagon, containing many articles of value, which we were obliged to leave behind for the benefit of future wanderers upon this trail. A fine ox, which I had brought along for food, died from the effects of heat.

Friday, July 22.—We have made but a short march of seven miles, in consequence of the casualties of yesterday. We obtained a wagon and pack-saddle from an emigrant. All hands are engaged in jerking the beef of one of our oxen, which, owing to the great heat of yesterday, was unable to go farther. The result of the process is doubtful with the thermometer at 105°, but we cannot afford to lose any of our provisions without an attempt to save them. We are encamped on the same creek; the grass is good, the water pure and cold, needing no addition of ice.

Saturday, July 23.—Raised camp at 3 o'clock, and were in march by 7 a. m., and advanced twenty-five miles to Willow creek, a small stream among the willows. The day has been intensely hot; our course was nearly parallel with the Columbia, about seven miles distant. We met many emigrants from Ohio and Illinois bound for California, Oregon, and Washington; they appeared wearied and wayworn, and were comforted by our assurance that the Pacific would soon put a period to their westward land-wandering. They wished us a good speed in our enterprise as only those hardy pioneers can who have walked over the route from Missouri to the Pacific States.

Sunday, July 24.—Thermometer at sunrise 61°; barometer 29.774. Marched thirty-five miles over a heath without trees or water to Butter creek. Day intensely hot, and some of our animals gave out. Butter creek is a fine cold stream, winding through a meadow covered with the most luxuriant grass. These beautiful streams are the redeeming features of this otherwise sterile region. I do not know why this is called Butter creek; but when its beautiful and fertile banks become the pasturage of herds of cattle, with an industrious population, its destiny will be accomplished, and the appropriateness of its name justified.

Monday, July 25.—Thermometer 53°; barometer 29.544. All hands roused at 3 a. m., but our animals not having been picketed, had strayed, and much time and labor were spent in collecting them. The loss of animals by stampedes, and straying, is one of the most annoying incidents of travel in this region.

In consequence of the great heat we advanced but fifteen miles, and encamped in a pleasant spot on the banks of the Umatilla river.

Near our camp we were met by a delegation of Cayuse braves, sent by the chief of the Nez Perces, to ascertain our object in passing through their country. They had been told that we were coming to make war upon them, and take away their horses. We assured them that such was not our object; that we had been sent by the great Chief of us all, at Washington, on a mission of peace to all the Indian tribes on both sides of the mountains, and asked them to invite their chief to come to our camp, and smoke the pipe of peace with us. In the evening the old chief came and smoked the pipe of peace with us, promised to be always friendly, and said that he was glad that our "hearts were good." The Nez Perces are a rich and powerful tribe, and own a great many horses. They cross the mountains yearly to hunt buffalo on the plains of the Missouri. They have a much shorter route to St. Mary's village, but it is too mountainous for us to take. The Bitter Root range of mountains between this and St. Mary's presents too great obstacles to the construction of a railroad. It is, therefore, necessary for us to go to the northward by the northern shore of Lake Kalispel. At this place we leave the emigrant trail, where it turns off towards the South Pass.

Tuesday, July 26.—Thermometer at sunrise, 62°; barometer, 29.684. Started at 2 a. m., on account of the indications of an extremely hot day before us; marched twenty miles, and encamped on the Columbia, within ten miles of Wallah-Wallah. It has been the hottest day of the season; men and animals suffered severely. Twelve miles of our route was over burning sands, destitute of vegetation; the animals sunk deeply into it at every step; its temperature was found to be, in several places, 150°; one of the mules gave out, and a poor tired horse tumbled over a precipice; his pack being of heavier material than his body, followed the law of gravitation, and came first to the ground, leaving the animal with his feet sticking in the air. He was assisted to regain his proper position, and quietly proceeded on his journey, his looks manifestly indicating his resignation to any fate that might befall him.

The pioneer who explores this interesting region must be prepared for all sorts of discouragement. Its vast desert wastes, dense forests, snow-capped mountains, and deep ravines, are obstacles which will call for all his energies and the exercise of his whole stock of philosophy. Here he will find himself surrounded by the grandest tokens of those mighty convulsions of nature which heaved up to the skies the ancient ocean beds.

I noticed to-day a very remarkable landmark, a vast column of basaltic trap, in form of a truncated cone, so regular in shape that it would almost seem to have been cut out by the hand of man, instead of being a singular specimen of nature's handiwork.

There is a beautiful island in the river near our camp covered with luxuriant grass, on which a large number of horses belonging to the Nez Perces are now feeding. They are driven here to pasture and fatten for the annual trip across the mountains.

Wednesday, July 27.—Thermometer at 7 a. m., 79°; barometer, 30. Arrived at Wallah-Wallah, and encamped two miles from the Hudson's Bay Company's fort. We were hospitably received by Mr. Pambrun, the factor in charge of the fort. We shall be obliged to remain here a short time to recruit our animals, as many of them are very much broken down and galled by the pack-saddles.

Mr. Hoyt's horse was drowned in attempting to cross a creek, and another this morning. The teamster, whom I had sent to this place from the Indian agency by a better road with our only wagon, came in and reported it broken down a few miles from this place. This is unpleasant news, as our means of transportation are very limited. We received several visits from the Wallah-Wallah chiefs and braves, who expressed a great deal of friendship for us, and seemed delighted to find that the reports of our hostile intentions were false. They are deadly enemies of the Blackfeet, and ready to join us in any expedition against them. We told them that war was not the object of our journey; that we came to smoke the pipe of peace with all the tribes.

They said they would "tell my news" to the chief, and that he would visit us to-morrow.

I employed an old voyageur of the name of Antoine Plante to guide us to Fort Benton. He is a quarter breed—French and Indian. His life has been spent in the mountains, trapping beaver for the Hudson's Bay Company, and once in his youth he crossed the mountains with the Kalispelm Indians to hunt on the plains of the Missouri. He has Blackfoot blood in his veins, yet bears a mortal enmity to the whole race, as they once, many years ago, were near taking his scalp. He is a rich Indian, above want, and I doubt if money would induce him to take the field. But when told that he was wanted to guide our party into the heart of his old enemies' country, faithful to his Indian instincts, his eye brightened, and he was ready to mount his horse.

Friday, July 29.—All hands busily engaged in jerking meat and preparing pack-saddles. The prospects of the expedition are anything but cheerful. The chief packer is sick, and obliged to leave the party; his assistant and several men are getting sick and dissatisfied with their hard work, and the prospect before them of boundless forests, and Indians whose dispositions are uncertain. The principal chief of the Wallah-Wallahs visited us to-day. He owns a thousand horses, and ranks high among the tribes of this region. He boasted of his friendship for the whites, and that none of his tribe had ever killed a white man.

The loss of our men is more disastrous on account of the difficulty of finding others to supply their places.

Saturday, July 30.—We left Wallah-Wallah very early this morning, and marched in a north-easterly direction twenty-five miles, and encamped in a very fine meadow on the banks of the Wallah-Wallah. The timber and grass are excellent, and the country around is beautiful. The chief, Pu-pu-mux-mux, sent a runner from his camp, forty-five miles distant, to inquire where we should cross the Lewis fork of the Columbia. I pointed out to him the place, and sent word by him to the chief to meet us there with men and canoes, to transport us across the river. The country through which we passed is a rolling prairie, without trees or water.

Sunday, July 31.—Thermometer at sunrise, 51°; barometer, 29.498. Left camp at an early hour, and after marching five miles, halted until evening. A prairie, forty-five miles in extent, is before us, entirely destitute of trees and water, and the heat is so great that it would be exceedingly hazardous to attempt to cross it before nightfall. We receive many visits from Indians; among them was an old Nez Perces, mounted on a fine horse, which he wished to exchange for an American one. We gave them a few presents, and I believe they left our camp very well satisfied with themselves and us.

Monday, August 1.—Thermometer at sunrise, 65°.5; barometer, 29.697. Arrived at Camp Peluse, at the junction of the Peluse and Snake rivers, at 5 a. m., after a night march of forty-five miles. The men and animals were much exhausted, and glad to rest their wearied limbs anywhere. Near the end of the march it was necessary to force some of the party along, fatigue and exposure to the night air having induced sickness. The march of last night could not have been made in the daytime at this season of the year. Great loss was sustained from the stampeding of the animals, the night being so dark as to render it impossible to recover all the lost packages.

Soon after our arrival, we were visited by a delegation of fifty Peluse and Nez Perces warriors, who came in full costume, and with great formality, to hold a grand "war talk." They seated themselves in a circle, the head chief in the centre, and the braves and warriors, according to rank, on either side; a few paces in the rear of the circle stood six Indians, dressed in very fantastic style, whom I supposed to be medicine men.

After completing their arrangements, they sent me word that they wished "to talk." I replied that we were all then too much tired, but that after we had eaten and slept we should be in a better condition to hold a council. They waited patiently till we were ready, then, after shaking hands all round, the chief lighted his medicine pipe, and, smoking a few whiffs himself, passed it to each member of the council, in the direction of the sun. The medicine pipe is a sacred pledge of friendship among all the northwestern tribes. After this ceremony, the chief inquired what was our object in passing through his country, with so many animals and such a quantity of merchandise. In reply, I informed him that I had been sent by my great chief through their country to visit the Blackfeet lodges across the Rocky mountains; that I was going thither; that I expected to meet there the chief of all the country between the mountains and the Pacific ocean, and that I wanted them to be ready with their men and canoes to help us in crossing the river, to bring in all our horses that had strayed, and to be in readiness, when Gov. Stevens should arrive, to give him any aid he would require. I told them that my great chief at Washington was their friend, and would protect them; he had sent them presents in token of his regard; and in addition to these, they would be well paid for any services they rendered us.

A fine young Indian who was present made an eloquent speech to the others. He told them that long ago his father was chief of the tribe, and owned all this country. They were then far more numerous, rich, and powerful, than now. His father extended the hand of friendship to the first white man who was seen in that country, and they must follow his example.

A consultation was then held among themselves, and when it was finished the old chief informed me that my "talk was good," and that, at any hour I should appoint, his men and canoes would be ready to take our baggage across the river. I gave them a few presents of tobacco, beads, &c. A specimen of our skill in rapid firing with Sharp's and Colt's rifles astonished them greatly, and created additional respect for our prowess—a favorable impression for a small party like ours, surrounded by bands of Indians. I told them that we should be ready to cross the river to-morrow at sunrise.

Thursday, August 2.—As our guide, Antoine, gave the war-whoop at daylight, fourteen canoes, manned by as many stout Indians, left the opposite shore and came across for our baggage. By 10 o'clock they had transported all our men and baggage across this swift and rocky stream, without injuring an article. Two horses were drowned in swimming. I then distributed the presents sent by the Indian department, with which they were much pleased. The old chief said they were "hyas iton"—very good—but some wanted more; and soon after our arrival at camp, fifteen miles distant, a party of seven warriors came in and reported that, in the distribution of the blankets, so many had to be given to the owners of the canoes that nothing was left for the chief. This system of begging, however, did not succeed, and the Peluse chief went away disappointed in his plan of financiering. He, however, soon brought us some corn and potatoes, and promised that, when Governor Stevens should arrive, he would kill a fat ox for us.

I found all the grass burned on this side of the Peluse river.

The Indians told me that a Spaniard had been along a few days before, and told them that a large body of American soldiers were coming to cut them off, and take possession of their homes. I satisfied them that our mission was one of peace, and promised if they would show me the persons who had endeavored to excite them to take arms against us, I would hang them on the first tree.

Wednesday, August 3.—From Camp Peluse to Camp Spokane, twenty-eight miles, over a better country than I have traversed since leaving the Dalles of the Columbia, I noticed a great amount of carbonate of soda in locations where, in wet seasons, there had evidently been pools of water. The ground in many places was perfectly white with it, and covered to the depth of three-quarters of an inch.

Last night an unfortunate accident occurred. Our only mercurial barometer was broken. Up to this point a good barometrical profile of our route had been obtained. Now this interesting and important part of the reconnaissance must be discontinued, or continued under great disadvantages with the aneroid, which will give only approximate results.

Thursday, August 4.—Thermometer at sunrise, 41°; barometer 28.89. Marched twenty miles to the north, over the finest grazing country I have yet met with; well watered, but destitute of game and trees. Rattlesnakes are so numerous as to render it dangerous to walk about in the grass. A Spokane Indian brought in four horses which he said had strayed from our last night's encampment. Some of the party, thinking he had concealed the animals and brought them in in order to claim the reward, were for having him tied up and whipped. But the man had an honest-looking eye; I believed him to be so, and paid him well for his trouble. Had we punished him unjustly, the whole Spokane tribe would have been our enemies, instead of being, as now, our fast friends.

The first forest trees I have seen since leaving the Dalles are in sight from our camp.

Friday, August 5.—Thermometer at sunrise, 40°; barometer 28.7. We marched twenty-five miles through a country of an entirely different character from any we have yet seen; a dense forest of pine and fir trees, many of immense size. We passed many beautiful ponds or lakes, and are encamped on the banks of a pretty sheet of clear water amid pine trees; but its waters are so strongly alkaline as to make them unfit for use, and very injurious to animals that drink of them. The native animals will not taste the water; but American horses and mules will when very thirsty, and unless speedily relieved by the administration of an acid, the consequences are disastrous. There is a spring near our camp strongly sulphureous, and boiling temperature fifty-one degrees.

Saturday, August 6.—Thermometer 58°; barometer 28.435. Marched in an eastwardly direction to Spokane river; the rock formation is granite. Passed a beautiful lake on the left of our trail; crossed a branch of the Spokane about three miles from its junction with the latter. At the ford where we crossed was an Indian village, and a wheat field of about an acre just harvested, which showed a fine crop.

Arrived on the banks of the Spokane at 12 m. As it was too deep to be forded, I hired the Indians to take us across in their canoes, and succeeded in getting everything safely over by sunset. The Spokanes are a noble specimen of their race, and are as yet too proud to beg. Their chief, Garry, speaks tolerable English, having been educated by the Hudson's Bay Company. He is rich, powerful, and owns a large number of horses.

The Spokanes, as well as the other tribes we had encountered, had been told that we were coming to make war upon them. They were delighted to find us friends, and came in great numbers to welcome us. About thirty mounted warriors, in full costume, formed upon a high hill overlooking our camp, and sang a song of welcome. It was just at sunset; and as they stood upon that eminence facing the setting sun, and made the hills and valleys echo with their wild music, the scene was strikingly grand and imposing.

I left three disabled horses with the chief of the tribe, which he promised to keep until my return. The Indians passed the night with us, and in the evening danced a war-dance, in which some of our men joined, and manifested decided talent for that sort of gymnastics. I gave them a few presents, informing them that they were sent by their Great Father at Washington. We parted in the morning well pleased with each other.

At this place I met Mr. Owen, who, with his brother, had spent several years at St. Mary's valley, engaged in raising stock and trading with the Indians. They have at length abandoned the place, deeming it unsafe to remain longer on account of the Blackfeet Indians. They are encamped about fifteen miles from us, with all their stock, on their way to Oregon, having left their goods and other property to the mercy of the Indians. Our coming will enable them to return and re-establish their trading-post.

Sunday, August 7.—Thermometer, 59°; barometer, 28.825. Marched twenty miles, to Camp Owen, on the borders of Cœur d'Alene prairie. Passed through a fine country, well adapted to cultivation, and by the falls of the Spokane, where the whole river pours over the rocks in a single sheet, and forms a beautiful cascade. This region belongs to the Painted Heart Indians, whose lands adjoin those of the Spokanes. The Indians we have met for the last few days are much superior to those nearer the coast; neater in their persons, and not beggars.

Up to this point we have had an abundance of fine salmon; but the falls of the Spokane arrest their progress beyond. An abundance of trout, almost equal to the salmon, compensate for their loss.

Tuesday, August 9.—Thermometer at sunrise, 52°; barometer, 28.64. We were occupied all yesterday in repacking our provisions and reducing our packs to the smallest possible size, in order to avoid difficulty in passing through a densely-timbered region, the trees in many places being so close as scarcely to admit an animal, without a pack, between them. Mr. Francis B. Owen goes back with us, glad of an opportunity to again take possession of his fort. We started early this morning, and continued our march until night through a dense forest of pines and firs. We were much annoyed by yellow wasps and hornets, with which the forest is filled. They stung our animals, who, maddened by the pain, dashed off with their loads among the thick trees. There is a lake at the right of our camp, but the shores are so marshy that the water is difficult of access. It was dark before our animals were taken care of.

Wednesday, August 10.—Thermometer, 44°; barometer, 28.605. Left camp early to avoid the yellow wasps, and to obtain grass. Marched ten miles, over a very bad road; part of the way through an almost impassable marsh, and obliged to cut our way through the thick undergrowth. Encamped in a pretty meadow of excellent grass, on Clark's fork of the Columbia, at the outlet of Pend d'Oreille lake. The river is about a third of a mile wide, and too deep to be forded. Found an old bateau, belonging to the Hudson's Bay Company, in a very leaky condition; all hands at work caulking it.

Thursday, August 11.—Thermometer, 34°; barometer, 28.635. We succeeded in fitting up the boat and crossing the bulk of our stores yesterday. Finished crossing this morning, with the loss of several horses. To relieve some of the weaker animals, Lieutenant Arnold proceeded to the upper end of the lake in the bateau with the bulk of the heavy articles, driving the animals along without their loads.

We had great difficulty in cutting our way through the thick timber. We met a party, numbering at least a hundred, of Pend d'Oreille Indians, just returning from a hunting excursion on the Missouri. All—men, women, and children—were mounted on fine horses, and were bound on a trading expedition with the tribes nearer the coast. They had at least 300 horses, and were loaded with buffalo robes and dried buffalo meat. They were perfectly civil, and seemed to feel proud, rich, and independent. They report that a large party of white men are coming from the east, to make peace with the Blackfeet; but their statements are so vague and unsatisfactory, that I can place no reliance on them.

Friday, August 12.—Thermometer, 40°; barometer, 28.665. Passed over twenty miles of very bad road, along the shore of Pend d'Oreille lake, a very beautiful sheet of water among the mountains. The southern shore of the lake is impassable, and is evidently the termination of the Blue mountains. On the northern shore, which we traversed, we were obliged to deviate occasionally into the timber, and climb some very steep hills, to avoid the water. The whole region is covered with a dense forest of pine, cedar, and other of the common forest trees of New England. On the shores of the lake are many fine meadows, covered with luxuriant grass. The lake is navigable, and no doubt that in a coming time, not very remote, its repose will be broken by the shrill scream and the paddles of the steamboat. I met many Indians, fine specimens of the race.

The mosquitos are very troublesome in the early evening, but the cold nights, universal in this region, put an end to the annoyance before midnight.

Saturday, August 13.—Thermometer, 56°; barometer, 28.575. Marched twelve miles to a camp occupied by the Hudson's Bay Company as a summer pasture for their cattle. The road was very bad, and our unshod animals had great difficulty in making their way over the sharp, flinty rocks; their hoofs were badly broken, and our trail might have been followed by means of the blood-stains upon the stones. I found Lieutenant Arnold here with the boat. He had had a pleasant voyage up the lake, and speaks in the highest terms of the beauty of its scenery, viewed from the water.

We were somewhat discouraged by the accounts of the route from this place to St. Mary's village given by a Scotchman who has recently passed over it. He says that for five days' journey there is no grass, it having been burned over by the Indians. Mr. Michael Ogden, the factor in charge of this camp, gives the same uncheering account.

Monday, August 15.—Yesterday was occupied in repairing camp equipage, and we left camp at an early hour this morning; passed over seventeen miles of very bad road; crossed the Cabinet mountain, a tremendous rocky elevation, covered to its summit with a dense thicket, through which we had to cut our way; while all along our path were the domicils of innumerable wasps and hornets. These stung our animals so, that some of them became frantic, and plunged off into the timber with their loads, which were thus stripped into a thousand fragments. In this way, some of our most valuable packs were lost.

We moved on until dark, when we encamped on Clark's fork of the Columbia river, amid the rocks, without a particle of grass for our animals.

Tuesday, August 16.—Thermometer at sunrise, 46°.5; barometer, 28.475. Started at 2 o'clock a. m. The march of to-day was worse than that of yesterday, though not so mountainous, as we have evidently got over the mountain ranges west of the Rocky mountains. Continuing along the valley of Clark's fork, occasionally deviating to avoid the rocks, we marched until noon, when we found a little grass, which our hungry beasts soon devoured. We then continued our march until nearly sunset, when we encamped at "Partridge camp," so called from the number of birds of that description usually found there. There is little grass; but enough, I hope, to sustain animal life for a day or two. Our animals are becoming weak and exhausted, and some of them, unless recruited, must give out to-morrow. The woods are on fire in many places—evidently for the purpose of retarding our progress.

The scenery to-day has been beautiful and grand, almost beyond description. At our noon camp, the rocks rise almost perpendicularly from the bed of the river to the height of 4,000 feet. Crossed many little streams of pure cold water emptying into Clark's fork; temperature, 40°.

Wednesday, August 17.—We prosecuted our march through the day, and encamped at night in a most miserable spot on the river, without any grass for our animals. Seven of our faithful pack-horses dropped upon the road, unable to go a step farther, and were left a prey to the wolves.

We passed an American horse with two bullet-holes in his flank, and one in his head, and much torn and mangled by the wolves; the fate of the owner of the poor steed is still a mystery. Called this camp Camp Dismal.

Thursday, August 18.—Thermometer, 42°.2; barometer, 28.005. Marched ten miles in an easterly direction, and encamped in good grass. The route has been through a dense forest, either burning or just burned, the ground being very hot for the animals' feet.

Friday, August 19.—Thermometer, 47°.5; barometer, 28.2. We marched to Thompson's prairie, a fine patch of high meadow land hemmed in by mountains. It is situated on Clark's fork of the Columbia, and covered with excellent grass. This is a favorite camping ground of the Indians on their hunting expeditions to the plains of the Missouri, and is occasionally visited by the Blackfeet, from the east side of the Rocky mountains, on their marauding expeditions to steal horses from the Flatheads, Pend d'Oreilles, and Spokanes.

The Hudson's Bay Company had formerly a trading-post here, but it has since been abandoned. The whole region is abandoned by the Indians and the few whites who have had trading-posts here, from fear of the Blackfeet. These renowned and formidable freebooters keep this whole region in terror during the summer season, as they come annually to steal horses and kill whomsoever they meet. The Flatheads and Nez Perces, in return, hunt the Blackfeet buffalo, and take life for life, with interest if possible. Thus a perpetual warfare is carried on between them.

We passed over a very fine region—high pine forest, with grass of the very best quality growing among the trees. From the top of a high mountain which we crossed we had a splendid view of the river, with its white banks of limestone winding among the trees. The whole country as far as the eye could reach was a dense forest.

Two more horses gave out to-day, dying from the effect of the previous day's labor without food. We had to take the greatest precaution to guard against fire; and notwithstanding our care, last night a quantity of provisions, saddles, &c., were burned. The grass and other undergrowth is so dry at this season of the year, that a spark is sufficient to set all on fire.

Saturday, August 20.—Remained in camp to give the animals rest. They are in a sad condition; their feet worn to the quick upon the stones, and backs very much injured by the pack-saddles. Last night we had a heavy rain—the first since leaving the Dalles.

Sunday, August 21.—Everything was wet last night, and our condition in camp was so uncomfortable that we started at an early hour. Crossed Thompson's river about a mile from camp, and marched southeast twenty miles to Horse Plains, a favorite camping ground of the Blackfeet Crossed the "Bad Rock," so called by the trappers; it is a compound of a mass of sharp, flinty stones—the termination of a high mountain which rises almost perpendicularly from the bed of the river to a great height. The feet of our animals were much injured in crossing it. Two pack-horses tumbled over the precipice and rolled down fifty yards into the river: one, rolling sideways, was but slightly injured; the other, going heels-over-head, was terribly cut and bruised. The men were about to put an end to his sufferings, but as he showed signs of life it was decided to give him a chance. Both followed on after the train, and will soon be able to resume their packs.

Monday, August 22.—Thermometer at sunrise, 37°.8; barometer, 28.115. Marched fifteen miles to Kammas prairie, over a very rough road, through an open pine forest. Discovered in the sand many tracks of Blackfeet. Antoine, the guide, says there are large numbers of them about, watching an opportunity to steal horses. The Indians come here to dig kammas, which is an important article of food among them.

The Blackfeet send war parties here to steal horses, and kill any whom they can take by surprise. As they are undoubtedly on our path, we keep strict watch by night. Lieutenants Arnold, Macfeely, and myself, alternate every two hours in keeping guard; not in the style of civilized strategy, but according to the aboriginal mode—hiding in a bush near the camp, ready to give a leaden challenge to any rash marauder who shall approach too near the horses. The Indians, seeing our vigilance, will probably let us pass unmolested.

I found two stray horses belonging to the Pend d'Oreilles. As they were much diseased with the glanders, I had them killed to prevent contagion. A French voyageur of our party begged hard for their lives, alleging that the killing of them would bring down the vengeance of the whole tribe upon us.

Tuesday, August 23.—Marched twelve miles to the river—Clark's fork of the Columbia. All hands are busily engaged in constructing a raft to take across the baggage. The forest resounds with the unwonted sound of the axe. We shall have some trouble in crossing, as the river is deep and the current rapid.

Wednesday, August 24.—We were occupied all day in completing the raft and crossing the baggage. The timber used in the construction of the raft is so heavy that it almost sinks in the water by its own weight. Navigation with such an unwieldy craft was exceedingly difficult. The party were at work in the water until 10 o'clock at night, and had passed over but about half of the loads. After this, a line of sentinels was posted to guard against the Blackfeet, who are supposed to be prowling around us for an opportunity to plunder.

Thursday, August 25.—Roused all hands at an early hour and completed crossing the baggage with our heavy and water-soaked raft; it was a tedious and severely-laborious operation. However, we succeeded in getting everything over in safety. Marched five miles and encamped in a beautiful meadow on Clark's fork, the men very much exhausted with the labor of rafting; many a silent vow was made not to serve Uncle Sam again. The soldiers may well complain; seven dollars a month is poor compensation for such hardships.

In the course of the night an alarm was made by one of the sentinels, who supposed that he saw an Indian. It was probably a bear, that had, by accident, strolled into the camp.

Friday, August 26.—To-day we moved our camp twenty-five miles to the southeast, and encamped on a small creek, a tributary of the Columbia. Our route was along the Flathead river, through a fine, open country, with an abundance of fine timber upon the hills back from the river. I found a great quantity of wild fruit, particularly excellent plums, nearly as good as those cultivated in the States.

For the last eight miles of the march we followed up the valley of Jocko river, a beautiful mountain stream, full of fine trout, and capable of supplying water-power enough to propel all the cotton-mills of Lowell.

Near our camp is a place called "Course de Femme" by the trappers; of which tradition is, that a white man many years ago lived here who used to make the squaws run foot-races for his amusement. Hence the name. I do not vouch for the truth of the tradition.

Saturday, August 27.—Arrived at "Hell Gate Run" after a march of twenty-eight miles. This is said, by the Indians, to be the best and almost only entrance to the pass through the Rocky mountains north of Pierre's Hole. A wild stream comes through the mountains at this point, called the Hell Gate river. It is not navigable, but would furnish excellent water-power. Up the valley of this beautiful river is the mountain pass through which the Pend d'Oreilles, Nez Perces, Flatheads, and other tribes west of the mountains, go to hunt on the plains of the Missouri. The western Indians take their families and property with them on those excursions, but the Blackfeet come west only on war parties, and therefore none but young men come.

Sunday, August 28.—After a march of twenty-eight miles we arrived at St. Mary's village. Much to my disappointment, Governor Stevens's party has not yet been heard from.

I had intended to place the provisions in depot here in charge of Lieutenant Arnold, and with Lieutenant Macfeely cross the mountains to Fort Benton; but in consequence of the lateness of the season, and the great losses sustained in transporting provisions, I find it necessary to send back every man who can be spared from the expedition in order to save, for Governor Stevens's party, as many subsistence stores as possible. According to all our information, Fort Benton is still at a long distance to the eastward.

I should do injustice to my own feelings, and to the services of a gallant officer, if I omitted to state that Lieutenant Macfeely, although anxious to cross the mountains, yet, with a generous devotion to the interests of the survey, consented to take the charge of the return party by a new route, taking such animals as could best be spared, and a much less quantity of provisions than prudence would dictate, in order to take as little as possible from the depot at St. Mary's village.

St. Mary's or Flathead village is situated near the western base of the Rocky mountains, on the St. Mary's fork of the Bitter Root river. It was laid out by the Jesuit missionaries, and completed by its present occupant, Mr. Owen, who had recently abandoned it from fear of the Blackfeet. The Flatheads have a considerable village of log-cabins around Fort Owen, and own a large number of cattle. They are now absent on a hunt across the mountains.

St. Mary's is at present deserted by the priests, to whom the Indians are indebted for much of their knowledge, and many of the comforts of civilized life which they enjoy. I saw a considerable quantity of wheat, just harvested. They have also eggs, milk, potatoes, &c., articles formerly unknown to the western savage.

September 2.—All hands have been occupied, since our arrival at St. Mary's, in making preparations for a final division of forces, taking an account of stock, and dividing the provisions, animals, &c., according to our respective wants.

Lieut. Arnold will remain here, in charge of the depot of provisions and animals, &c., with Mr. Arnold, his assistant, and four men. He will complete his observations for latitude and longitude.

Lieut. Macfeely, with two men and seventeen packers, will take twenty-three days' provisions, and return to Fort Vancouver by the Nez Perces trail—a shorter but more mountainous route than that which we came over.

I shall take Mr. Hoyt, my assistant, Antoine Plante, the guide, and sixteen men, and go by the way of the Blackfoot Pass to Fort Benton. I would take a less number of men with me, but Antoine, entertaining his old dread of the Blackfeet, refused to accompany me with fewer men. He is an old mountaineer, and his services are invaluable.

We obtained an abundance of excellent beef from Mr. Owen, the owner of the fort.

After providing for Lieut. Macfeely's party and my own, I have something over two thousand rations to leave in depot for Governor Stevens's party. These I have turned over to Lieutenant Arnold, together with sixty-five disabled horses, and a quantity of ammunition and quartermaster property.

The companions of our long and weary march, from whom we separated at this place, gave us three hearty cheers as we parted from them—an earnest of our success. They would willingly have gone on with us, but the scarcity of provisions would not permit it.

We marched twenty-five miles, and encamped in a fine meadow within five miles of Hell Gate. Discovered the first bear we had seen, but did not succeed in capturing him.

September 3.—Barometer at sunrise 27.68; thermometer broken. We passed through the Hell Gate along the banks of the Blackfoot river. I think it decidedly a misnomer to call this beautiful region by so unholy a name. The sun does not shine on a better spot of earth.

I find that my previous ideas of the Rocky mountain range were, so far as this section is concerned, entirely erroneous. Instead of a vast pile of rock and mountains, almost impassable, I found a fine country, well watered by streams of clear cold water, and interspersed with meadows covered with the most luxuriant grass.

September 4.—We crossed to-day the highest mountain in our route. It is one of the Rocky mountain range, and I think may be avoided in the construction of a railroad. It was raining heavily when we crossed it. It is covered to its summit with a heavy growth of timber. Saw some fine specimens of granite, and also quarries of white and variegated marble.

After crossing the mountain we came to a fertile prairie, which we crossed, and passed through ten miles of excellent timber, and camped in Kammas swamp, twenty-five miles from our last night's camp. This swamp is resorted to by the Indians to gather kammas. Guide Antoine recognised it as the spot where, in former years, he used to hunt beaver, before the Blackfeet came so near getting his scalp. Though it is eight years since he was here, he knows every hill and stream, and guides our little band through this unbroken wilderness, without a trail, as true and unwavering as the needle to the pole.

September 5.—Marched twenty-five miles due west, along the banks of the Blackfoot Fork river, through a magnificent country, fitted to support a numerous population of civilized men. Its bracing air, and grand mountain scenery, will give inspiration and energy to the future inhabitants of this mountain region.

Our camp is in "Day Meadow." The grass is excellent, but game scarce: the Indians have probably driven it away. The Indians resort here in the summer to hunt.

September 6.—We marched thirty miles, and are now encamped on the last dividing ridge of the mountains. Antoine says that we shall see to-morrow the long-looked-for plains of the Missouri. We passed through a region of the same fine character as that of yesterday, but with more timber, and more game. I saw numerous large, fine-looking elk, which would have made a welcome addition to our slender stock of provisions; but we did not succeed in taking any.

We are now near the headwaters of the Blackfoot fork, a branch of the Hell Gate river, full of mountain trout. The grass and timber are as good as can be found anywhere. It is contrary to all my preconceived ideas of the Rocky mountains, to find such a country in their very heart. Saw to the northeast some high snow-capped mountains.

September 7.—Crossed the last dividing ridge of the mountains, and are encamped on a small creek upon the eastern side, one of the head branches of the Missouri. The ridge which divides the waters flowing into the Atlantic from those flowing into the Pacific, at the place where we crossed, is but a high hill, and it is not more than a mile in a straight line between the sources of the Columbia and the Missouri. Nature seems to have intended it for one of the great highways across the continent. We stooped and took a parting glass of the clear, pure water of the Columbia, and in a few moments pledged the toast from the stream whose waters flow to mingle with the Gulf of Mexico. The view from the summit of the pass is grand and beautiful; the Atlantic and Pacific slopes of the mountains spreading out on either side, and embracing on this hill of union, as well as separation.

The mountains, at this point, offer no obstacle to the construction of a railroad from this place to the Flathead village. With the exception of one mountain, easily to be avoided, a finer region through which to build a road can nowhere be found. The vast amount of timber and stone, granite and marble, will furnish an inexhaustible resource of materials for its construction.

One of the men to-day killed the first deer that has been killed by our party. We halted and made a feast, roasting large piles before the fire. We ate with the keen appetites which the pure mountain air gives.

The day has been cold, with slight rain. We found little game beyond the mountains; and any expedition that should depend upon it for food would be apt to go hungry.

The barometer gave for the highest point of the dividing ridge an altitude of 4,674 feet above Fort Vancouver.

September 8.—The day has been cold and rainy. The tops of the high mountains in our vicinity are white with last night's snow, warning us of the coming winter.

We were unexpectedly and most agreeably surprised by the arrival, at about 9 a. m., of Lieutenant Grover, 4th artillery, with a party of nine men, on their way to St. Mary's village. We gave them a hearty welcome. Lieutenant Grover brings news of the arrival of Governor Stevens at Fort Benton. The meeting was a pleasant one for all parties. We felt that the plan of our operations had been successful, and the object of the expedition accomplished; as a party from the Atlantic, and one from the Pacific—each in search of the other—had met, by appointment, after traversing thousands of miles of unknown country, at the foot of the great dividing ridge between the oceans. We passed the day in camp, celebrating the reunion.

September 9.—Marched twenty-five miles, and encamped in a meadow of good grass, but without water. Lieutenant Grover and party return with me to Fort Benton.

September 10.—Marched twenty-five miles, and encamped on the banks of a lake, where we found plenty of water and grass; but for the first time since leaving the mouth of the Columbia we were destitute of wood. Buffalo-chips enough to cook our food were collected.

September 11.—Marched twenty-five miles, and encamped on Teton river, six miles from Fort Benton. Passed the Falls of the Missouri at a distance, but near enough to see the spray rising from them. We missed the route once, and for the first time in all our long march, and came too near the river, and thus became entangled in a labyrinth of ravines and deep hollows, and lost nine miles of distance. I was, however, repaid for the deviation by the pleasure of meeting Dr. Evans, the eminent geologist, and his party, on their way to visit the Falls of the Missouri.

September 12.—I arrived at Fort Benton, and found that Governor Stevens had gone to Cypress mountain to hold a council with the Blackfeet Indians. Lieutenant Donelson commands the main body during his absence.

I was detained at Fort Benton until September 22d, making preparation for a voyage down the Missouri, which, in pursuance of instructions, I commenced on that day. I was ordered to examine as carefully as possible the regimen of the river, with reference to the possibility of bringing a steamboat as far as Fort Benton. I was not required to make a detailed map, that having already been done by the surveys of Lieutenants Grover and Donelson.

A continuation of my journal from this point to St. Louis will give the results of my observations, confirming the views you entertain as to the navigability of the river.

September 22.—We started at daylight on the keel-boat Blackfoot. The party consists of Mr. Culbertson, Indian agent, and wife; Mr. D. S. Hoyt; Mr. W. M. Graham; four quartermaster's employés; seventeen dragoons of company D, 1st dragoons; some discharged employés from the expedition; and Mr. Tevis, of St. Louis, passenger. The Blackfoot was built by the American Fur Company at this place, and draws, when loaded, about eighteen inches of water. With two reliefs of ten men each, I hope to be able to paddle to St. Louis in thirty-five days.

Governor Stevens starts this morning for Olympia, Lieut. Donelson having left with the main party a few days before; Lieut. Grover also left for Fort Union at the same time, charged with the duty of making a careful survey of the river to that point. It was a grand breaking up of the largest party of white men ever congregated in this far-off wilderness. The salute from the fort was returned, with interest, by the little cannon on board the Blackfoot. The natives listened, in silent wonder, to the echo and re-echo of the white man's thunder, and wondered what was its meaning.

The river is said to be unusually low at this time, so that any results now obtained may be relied on as true at all seasons of the year. There has been no place to-day where a steamer drawing two feet cannot pass. Wood is rather scarce, but enough can be procured to run a steamer for a long time to come. We made about eighty miles.

September 23.—We were detained for several hours to-day by the wind. The channel is so crooked that, in a windy day, our unwieldy boat cannot be navigated. I saw numerous mountain sheep and antelopes along the banks of the river, within gun-shot of the boat.

September 24.—We passed through the "Mauvaises Terres," one of the most desolate regions in the world, entirely cut up with deep gulleys and ravines, almost impassable, and destitute of vegetation. It is rich in fossils. Dr. Evans has spent much of his time in investigating this region, and an amount of valuable information will doubtless result from his labors.

September 25.—Detained to-day by head winds, so that we made but little progress.

We anchored at night within a few miles of Muscle Shell river; saw a great number of deer, elk, and bears along the banks. The timber on the river is excellent, the soil good, and very few obstructions to navigation by light-draught steamers.

We met a boat belonging to the Fur Company, loaded with merchandise for the Indian trade, and towed up this rapid stream by eighteen French voyagers—a most laborious work. They had been thirty-two days in coming from the mouth of the Yellowstone. At this rate of travel they will not reach Fort Benton before winter. These men are a hardy race, able to endure an immense amount of fatigue and exposure, yet always cheerful, and, with a hunter in attendance to supply them with buffalo meat, content to toil on uncomplainingly. I believe it will not be long before this uncouth and laborious mode of navigating this magnificent river over to the Falls will be superseded by the all-conquering force of steam.

September 26.—A rainy night and morning. We made a fine sail down the river, and saw a great deal of game—buffalo, bear, elk, and black-tailed deer. We killed a fine specimen of the latter, and found its meat excellent. I think that no portion of the world can boast of a greater profusion of game. We see constantly large numbers of the above-mentioned species swimming the river in advance of the boat, and evidently very little concerned at our approach. A large grizzly bear swam across near the boat. A broadside of twenty Mississippi rifles was fired at him, but he passed on apparently unhurt. He looked a little astonished at the sound of the rifle, but shook his shaggy main and galloped to the woods.

October 2.—We arrived at Fort Union, near the mouth of the Yellowstone, about 9 o'clock this evening, without having met with any trouble from low water or Indians, having travelled from Fort Benton, seven hundred and fifty miles by the river, in eleven days. For the last few days we have seen innumerable herds of buffalo-cows, in many places extending in every direction as far as the eye could reach. They are very fat at this season, and I would consider their flesh preferable to beef.

We were visited by a party of Assiniboins. They are very rich this year, on account of the abundance of buffalo, and offered to bring us a large supply of dried meat if we could wait till they could send for it. As progress is of more importance than anything else, we were obliged to decline their hospitality.

October 5.—After spending one day at Fort Union in making preparations, we proceeded on our voyage down the river. Our progress is but slow, the innumerable snags and sand-bars in the channel making the navigation almost impossible in the night; and by day, the wind frequently impedes our advance by rendering the Blackfoot completely unmanageable.

The buffalo-cows have all gone to the north. We occasionally see a few bulls, but they are lean at this season of the year, and their flesh not at all palatable. The male and female do not range together at this season.

I think Fort Union is the finest place on the Missouri for a military post—in the heart of the Indian country, surrounded with a fertile soil and the finest hunting range, and of easy access by the Missouri for eight months in the year. Few positions in the Indian territory can be occupied so advantageously and with less expense to the government.

October 8.—For the last three days we have continued our slow progress down the river, contending with fogs, head winds and sand-bars, through a fine region, full of game, and occasionally speaking a hunting party of Gros Ventres out after buffalo. But to-day has been a day of accidents. We landed on a sand-bar just after starting, and had scarcely got under way again when the wind commenced blowing a perfect gale, and compelled us to lie by until sunset, when the wind lulled and we started down the river. We had gone but a short distance when the boat ran upon three snags lying close together; two of them sticking about six feet out of the water, and eight feet apart, and the other midway between them, about eighteen inches in diameter, its blunt end just above the surface of the water, and all pointing up-stream. One of the snags passed directly over our bows, breaking three of our oars; and assisting, with our whole weight, to press down upon the middle snag, which was threatening every moment to break through the bottom of our weak craft, we worked until 10 p. m., endeavoring to get off, without success; and here we are in the middle of the Missouri, with fifteen feet of swift-running water for more than one hundred yards on each side of us, the bow of our boat resting on a firmly-fixed snag, which threatens every moment to sink us. I established a strict guard over the dangerous spot, with intentions to rouse all hands if the snag should break through in the night.

October 9.—All hands roused at daylight; the boat still above water, but in a very bad situation. We constructed a raft to transport everything ashore in case the boat should be lost, but still persevered to keep the Blackfoot afloat, as a walk from here to St. Louis would be anything but pleasant. Some Gros Ventres came to offer their assistance; but little could they do to help us, as they had no canoes to come aboard in, and we had no materials to construct a raft to bring them, but only to manufacture a rough raft on which to save ourselves in case the boat went down. The snag is directly under the centre of our boat, and acts as a pivot as we swing the stern backward and forward in our efforts to get her off. At length we happily succeeded in bracing up the bottom of the boat and lifting it off the snag.

Arrived at Fort Berthold about sunset. We received many visits from the Gros Ventres, and gave them a few presents. The Gros Ventres have a large village of mud houses—very unsightly outside, but within warm and comfortable.

These Indians are fine specimens of the red man. They are industrious, and raise even enough to supply many of their neighbors with bread. They are well disposed towards the whites. The American Fur Company have a trading-post here. These Indians, in common with some other tribes, have a peculiar method of disposing of the bodies of their dead. They are placed upon a scaffold six or eight feet above the ground, enveloped in all the blankets, robes, &c., which belonged to them when alive, with a supply of food, arrows, moccasins, &c., for the use of the deceased in the happy hunting-grounds. The last resting-place of the Indian is as sacred to his friends as the white man's tomb, and whoever should disturb it in any way would expose himself to an Indian's vengeance.

October 10.—I visited some of the lodges of the Gros Ventres, and found them exceedingly comfortable and capable of accommodating comfortably a hundred persons. One part of the lodge is appropriated to their horses, dogs, cattle, and chickens, and another to their own sleeping apartments. They all seemed to live sociably and comfortably together during the long cold winters of this cold latitude. The lodges are built entirely by women, who, in fact, do all the domestic work. The men scorn to labor at all; and were they to descend to so undignified and womanly employment, none would have so great a contempt for them as the women themselves. Next to taking the scalp of an enemy, the highest glory of a northwestern Indian is to be an adroit horse-stealer. A brave, or young man, ambitious to win a standing in his tribe, will run any risk to steal a horse from any one, and frequently loses his life in the attempt. We left Fort Berthold early; but, before we had advanced far, were driven ashore by a strong wind, which continued throughout the day. The smoke from the burning prairies is so dense as almost to hide the sun. The fires, burning in every direction, present at night a beautiful and magnificent, though terrible appearance.

October 11.—Arrived at Fort Clark, or Aricaree's village. It is situated on the top of a very high bluff on the bank of the river. All boats, passing up or down, are obliged to pass directly beneath this bluff; so that the Indians could easily sink any boat undertaking to pass against their will.

The Rees are not friendly to the whites, and are kept from open hostilities only by fear. They are a large tribe, and on the fertile meadows they occupy, raise a great amount of corn and pumpkins, which they exchange with the Crows and Dacotahs for dried buffalo meat and robes. They exported five thousand bushels of excellent corn this year. The work is done by the women. Twenty-five hundred Dacotahs have just been here to trade. After buying everything for sale and stealing all they could, they left for the buffalo country, taking care to set the prairies on fire, in order to prevent the buffalo from visiting the Rees country—an act of dastardly malignity, as it deprives the Aricarees of the means of support for their horses and cattle.

A few miles above Fort Clark is the Mandan village. The Mandans are the finest Indians in America. They number about two hundred now, the tribe having been reduced a few years ago to eighteen souls by the smallpox. Scarcely one who was attacked recovered; and such was their desperation, that often when one was satisfied that the disease was upon him, he would throw himself into the river from the high bluff on which the village stands, in order to escape the agonies of that dreadful and loathsome disease.

We passed the mouth of Knife river: on the plain above was fought, in the autumn of 1837, between the Assiniboins and Gros Ventres, one of the most bloody battles in the annals of Indian warfare. The Assiniboins, numbering four or five hundred, led by "The Left-Handed," the greatest chief they ever had, attacked the Gros Ventres, and, after a long and desperate battle, were defeated, leaving seventy-five of their best warriors dead upon the field. Some of those who escaped came to Fort Union, at the mouth of the Yellowstone. Mr. Culbertson describes them as terribly cut up and mangled. The Gros Ventres suffered but slightly in comparison with their enemies.

October 12.—Left the Ree village at an early hour, and continued the voyage till noon, when we were compelled by the wind to lie by till evening. The country is on fire in every direction, and the dense smoke with which the atmosphere is filled produces a very injurious effect upon the eyes.

October 13.—Fortunately there was no wind to-day, and we made a fine run down the river, passing three encampments of Dacotahs. At the first, a very large one, several hundred warriors were collected on both sides of the river, completely commanding the passage. As we approached, the chief hailed us and ordered us to land. Around him stood a hundred grim warriors with guns, and bows and arrows, ready to enforce his orders. Disobedience would have brought down a shower of destructive missiles. There was no questioning the mandate of the royal savage. Discretion here was manifestly the better part of valor; so, pride yielded to prudence, and the Blackfoot was brought to shore.

The Indians were somewhat saucy and peremptory, as if presuming upon our weakness, but offered no insult; only demanding a supply of tobacco. I told the chief that we had not come from a tobacco country, but had crossed the Rocky mountains, and seen thousands of Indians, all of whom expected something, but that I would divide my little remaining stock with them. As they seemed bent on mischief, I thought it best to end the interview. As the boat left the shore, an arrow was discharged at the pilot from behind a clump of bushes. It fell short of its aim, and penetrated deeply the timber of the boat. The fellow who fired it being concealed, prevented the rifles of my men from reaching him. This was probably fortunate, as, had we killed the assassin, it would have undoubtedly brought a useless conflict, perhaps fatal to us, and, at any rate, exposed us to perpetual annoyance from this powerful tribe in our further course down the river. A fine old Indian, seeing the serious turn things seemed to be taking, came running down to the river, swam out to the boat, and wanted to accompany us through the Dacotah country, in order to tell his people that they must offer no impediment to our voyage. He expressed a great deal of indignation against the Indian who had shot his arrow at us; said he had a "bad heart," and would not be upheld by the brave of the tribe. Our volunteer friend was faithful to his professions, as, at the next encampment we encountered, we were treated with perfect civility by the tribe. Soon after sunset we reached the main encampment, situated on the left bank of the river upon a commanding bluff, one hundred feet high. The sides and top of the hill were covered with Indians, to the number of three hundred warriors. As we reached the landing our friendly chief told them what had happened above; that we were in much hurry to get on our way; I had only stopped there to give them a little tobacco. They listened in silence to the old chief, and suffered us to proceed without molestation or insult. These Sioux hold the white man's power in a good deal of contempt, and are sadly in need of a lesson. We kept on all night, in order to get out of the way of these dangerous fellows. Fortunately, it was a clear, still, moonlight night, and before morning we were at a long distance from them.

October 14.—Arrived about 12 o'clock at a small trading encampment of the American Fur Company. Found a large body of Sioux here, who were tolerably civil, and invited us to stay a day or two, to attend a dog-feast. We felt no particular desire to cultivate an intimacy with people so inauspiciously commenced, and I declined their hospitality. We gave them a few presents, and bade them good-bye for the present. We took on board an old Indian who is going down to Fort Pierre with us to see the Indian agent.

October 18.—We reached Fort Pierre about 12 o'clock m. During the last four days we have had many detentions from high winds and sand-bars. The river is so low, and the channel so crooked, that it is impossible to get along without running high and dry upon the sand-bars. The men have worked with praiseworthy energy, standing in the water at a temperature of 40° until they were completely chilled. Two days before our arrival at this place, the main body of the Yankton Sioux, in number some twenty-five hundred, had left for the buffalo country. They have been here to receive their presents from the government. Two more bands are expected in a few days.

October 20.—We made but little progress on account of the wind. About dark met a boat, loaded with potatoes and other vegetables, belonging to the American Fur Company. They were raised on an island a few miles below. We obtained a sufficient supply for the remainder of the voyage.

October 21.—The high wind continuing, we made but little progress. Passed Fort Pierre island—a fine, fertile spot in the Missouri, containing several hundred acres of excellent land. The American Fur Company raise all their corn and vegetables here. When this country is settled this island will be very valuable.

October 23.—For the last two days we have made but little progress, as the wind has been blowing a perfect gale. To-day has been calm, and we have made a fine run down the river. The banks this morning were frozen quite hard, and some ice was formed at the edge of the water, indicating that the navigation would soon be closed for this year. We were continually running upon sand-banks, and all hands were obliged to go into the water to lift the boat off; anything but a luxurious bath, in this frigid temperature. Passed through the Great Bend of the Missouri, and encamped at night near the mouth of the White Earth river. The night is cold and windy, and clouds around the setting sun indicate snow for to-morrow.

October 25.—We have made but one full day's run since leaving Fort Pierre, having been wind-bound most of the time. To-day the wind has abated somewhat, and we made out to reach Cedar island, after working at the oars steadily for twelve hours. The island was formerly occupied by the Mormons, but the Indians proving troublesome, they were obliged to abandon it. The water is uncommonly low, with very little current, and our progress is consequently very slow. Passed several hot sulphur springs twenty-five miles above this place. Their water is clear, and evidently strongly impregnated with the mineral. Saw wild turkeys for the first time. They are seldom seen above this point, and have never, I believe, been found beyond the Rocky mountains.

October 30.—For the last few days we have had fine weather, and made a long distance down the river. We have passed Floyd's bluff, so called in commemoration of Sergeant Floyd, one of the men belonging to Lewis and Clark's expedition, which crossed the mountains in 1804, who was killed here. We fired a salute in honor of the brave sergeant who, forty-nine years before, was of the party that had started to explore the route we had just traversed.

The region through which we passed appears to be as favorable for agriculture as any in the United States. I saw to-day, at a cabin where we stopped, some of the best specimens of grain and vegetables I have yet seen.

We are encamped within sight of "Blackbird's Hill," so called from a famous Indian chief, who, at his own request, was buried on horseback on the top of it, in a commanding position, that he might see the white men as they came up the river. It is not an unfrequent custom among some of the northwestern tribes to bury a warrior with his favorite horses, which are killed for that purpose. It is not a rare exhibition of filial affection and faith for a son to kill his best horses—almost the only wealth an Indian has—and put their bodies in the grave of his dead father, in order that he may be equipped for hunting buffalo in the happy hunting grounds.

I saw immense flocks of geese, swans, and brants on the wing for the south in their autumnal migration.

The prairies are burning in every direction, and the smoke is almost stifling. From this point to Fort Leavenworth the country is so well known that a further description is unnecessary in this report. The Indians are friendly, and acquainted with the whites, and the river well adapted to steamboat navigation.

On the 8th of November, when a few miles below St. Joseph, Missouri, we were gratified by the sight of the steamer Honduras; she passed up the river in the face of a high wind, which had blown the Blackfoot high and dry upon a sand-bar. On the 9th we transferred our persons and property to the steamer, took the Blackfoot in tow, and started for St. Louis. The change was agreeable to us all, after having been confined for nearly fifty days in a small keel-boat, and weather-bound sometimes for days together.

The soldiers of the dragoon escort deserve great credit for the cheerfulness with which they endured the hardships, ordinary and extraordinary, of the long navigation from Fort Benton. Though frequently obliged, when the boat was aground or missed the channel, to work in the water, often when the thermometer was below the freezing point, and ice upon the shores of the river, they did not shrink nor murmur, and are entitled to this expression of cordial approbation.

I turned over the keel-boat to the quartermaster at Fort Leavenworth; left the soldiers and discharged employés at St. Louis; and, in company with Mr. W. M. Graham and Sergeant Collins, arrived in Washington on the 21st of November.

From as careful a survey of the country through which I passed as the limited means at my disposal, and the rapid rate at which I travelled, would admit, I give as the result of my observations:

First. That, from the mouth of Wallah-Wallah river to Fort Benton, no insurmountable obstacle to the construction of a railroad exists, and that the Blackfoot or Cadotte's Pass is much the lowest pass through the Rocky mountains that has yet been discovered, and eminently fitted by nature for the line of railroad.

Second. That the region is well watered, rich in agricultural and mineral resources, and abounding in fine timber and all other materials necessary for the construction of a railroad. It is destined, and at no very distant period, to be occupied by a civilized and energetic population, capable of making roads for themselves, independently of those which are to form the great lines of communication between the eastern and western oceans.

Third. That, in a military point of view, it is of the highest importance that treaties should be entered into with all the wild tribes of Indians who inhabit the Northwest, not included in existing treaties. It is important that they should be made to realize the power and strength of the United States government, and look to it for protection and justice, instead of looking to United States officials as intruders, and owning, as many do, England as their natural guardian. In case of difficulty between the two countries, the powerful tribes might be made the instruments of incalculable injury to our frontier settlements. It ought, therefore, to be made obviously their interest to be on good terms with the United States. Any hostile feelings they may entertain towards us should be conciliated by a policy uniformly and unequivocally characterized by justice, forbearance, and generosity.

The Missouri river offers the means of easy communication with them. It is navigable to the falls, or near them, and there the most remote tribes can be collected.

Many of the tribes are now deadly enemies, but have promised to stop fighting until next summer, and then to meet in council to hear the "white man's talk," and, if possible, to establish a lasting peace with them, and with each other. By sending up a steamer, annually, with supplies of articles, useful or desirable for the Indians, they will soon understand the advantage of friendly intercourse with us, and suffer emigrant parties to the west, beyond the mountains, to pass unmolested and in safety. The importance of the proposed convention of tribes at Fort Benton can hardly be exaggerated. Every principle of justice and policy to the Indian, to the emigrant, and to the United States, requires that some honest arrangement of the relations of the government and the tribes should be made in good faith. Whether they can ever be reclaimed from their present wandering life, and fixed in permanent homes, is a problem not yet perhaps absolutely solved, but upon which experience has cast some light. Whether they are destined to pass away before the advance of civilization, with the buffalo that forms their subsistence; whether contact with the white man shall always work the degradation of the Indian; by a wise, just, and humane policy on our part, open hostilities between the two races may be prevented, and thus one formidable obstacle to the success of the object to which our labors the past season have been directed—the finding of a safe way for emigrants to the farthest west and for the construction of an inter-oceanic railroad—will be removed.

I am, sir, respectfully, your obedient servant,

RUFUS SAXTON,
Second Lieutenant Fourth Artillery.

Hon. Isaac I. Stevens,
Governor of Washington Territory.

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18. Report of Lieutenant Donelson as to the railroad practicability of the route from Fort Benton, by Lewis and Clark's and Cadotte's passes, Blackfoot trail, the Bitter Root, and Jocko lines, to Clark's fork, and thence across the great plain of the Columbia to Wallah-Wallah; with the reports of Lieutenant R. Arnold, U. S. A., and Messrs. F. W. Lander and A. W. Tinkham, assistant engineers.

Olympia, Washington Territory,
February 23, 1854.

Sir: I have the honor to submit the following report of the survey of a route for a railroad from Fort Benton, across the Rocky mountains, by way of Cadotte's Pass, to the valley of the Bitter Root river, and thence, by way of Clark's fork and the Spokane house, to Fort Wallah-Wallah.

The party you had designated for the prosecution of this survey moved from camp, near Fort Benton, at noon on the 16th of September. Mr. Lander, the engineer for estimates, started on the 15th, and having joined his party, which was encamped on the Teton, some miles above where we were, moved forward on the 16th towards Sun river. He was to pursue a course north of that, to be followed by the main party, and, crossing the mountains by a favorable pass, to proceed thence to the Flathead village.

The course of a railroad line from Milk to Marias river having been determined by Mr. Tinkham, and from the Marias to the Teton by reconnaissance of both Messrs. Lander and Tinkham, the above-mentioned disposition of his party enabled Mr. Lander to carry forward a line, to estimate cost, &c., to the valley of the Bitter Root river. On the 19th Mr. Tinkham left the party for the purpose of reconnoitring Sun river, as an approach to the mountains. He was to meet us again on the Dearborn, or at some point not far beyond.

Having passed the ridge which separated the waters of the Atlantic ocean from those of the Pacific, on the 22d of September, we reached the Flathead village on the 29th. I here received instructions from you as to the further continuation of the survey. Mr. Tinkham, who had left the main party on the 26th for the purpose of examining a route which led to the Jocko river, did not return until after we left the Flathead village, and was then placed by you on duties which separated him from the main party. In continuing the survey, Mr. Lander was directed to follow the Bitter Root to its junction with Clark's fork, in order to determine its practicability for a railroad. The main party passed from the Bitter Root to the Jocko, and following the latter to its mouth, entered the valley of Clark's fork. Mr. Lander rejoined us at Horse Plain. Hence we pursued the line of Clark's fork to a point twelve miles below Lake Pend d'Oreille. Here Lieutenant Arnold left with a select party for the purpose of connecting the line with Fort Colville and with Captain McClellan's survey, in case he should not have arrived at that point. The main party crossing to the Spokane river, thence proceeded to a point twelve miles west, where we met yourself and Captain McClellan with his party.

Here terminated the operations directed in your instructions to me of the 2d of October. But, in pursuance of further orders, the party, organized as before, proceeded to Wallah-Wallah. We followed an Indian trail, and crossing the Saptin or Lewis's fork of the Columbia, at the mouth of the Peluse, arrived at Wallah-Wallah on the 6th of November.

The results of the survey, which tend to show the capacity of the country for a railroad, must be briefly stated. From Teton river to the foot of the dividing ridge are two summit levels to be attained, and on the route we followed a difficult approach to that ridge, along the sides of the mountain spur, adjacent to the south fork of the Dearborn. The following are the probable gradients on this route: From the Teton to the first summit, twenty-one miles of ascent, at the rate of twenty-seven feet per mile. Then to the crossing of the Sun river, thirty-one miles, descending at seventeen feet per mile. To the second summit an ascent of twenty miles, at the rate of forty-four feet per mile, but this with the supposition that there will be a tunnel of half a mile in length at that summit. From here to a point on the south fork of the Dearborn would be sixteen miles, with gradients of twenty feet per mile. Then to the foot of the dividing ridge, eight miles of heavy and costly work, and with an ascending gradient of not less than sixty-five feet per mile. While this route is thus barely practicable with respect to the gradients, it is exceedingly unfavorable in other respects. A portion of the country between Sun river and the Dearborn is so very rugged, that it would be advantageous to make a considerable detour to cross it, and this detour could not be made after passing the former stream.

From Mr. Tinkham's report, I would judge that the approach along the route he followed is far preferable to that which has been considered. And if, as I have estimated, the direct approach can be made with a gradient of sixty-five feet per mile, the oblique approach will not require one steeper than sixty feet. In the matter of construction, it may be said that Teton, Sun, and Dearborn rivers would furnish sufficient sand and gravel for the road-bed, and would contribute to the supply of timber, their banks producing a moderate quantity of good cotton-wood. The remainder of the timber would come from the mountains in the vicinity of the pass, where grow yellow and pitch pine—a good quality. The soil between the Teton and Sun rivers is favorable for the purpose of a railroad; that between the Sun and Dearborn containing a large proportion of clay, would be somewhat affected by frost. I noticed but one locality of good building-stone, and this was a few miles to the east of Beaver creek. In a country where, like this, a variety of rock is known to exist, it is reasonable to suppose that extensive deposits of good building-stone could be found: one of these being connected with the line by a branch railway, would provide for the supply of this material. The point at which I have supposed the main tunnel should commence on the eastern side, is one thousand and fifteen feet below the mountain summit. The tunnel would be four and three-quarter miles in length, and would issue at a point three and a half miles from the western base of the dividing ridge. In this connexion, it should be remarked that the western is five hundred and sixty-seven feet higher than the eastern side of the mountain.

The location of the road east of the mountains was not decided upon with sufficient detail to enable me to speak positively concerning the curves. The deflection from the direct line, connecting the crossing of the Teton with the pass, would be inconsiderable, and by curves, according to my estimate, of from two to six thousand feet radius at the crossings; to avoid the uneven ground between the Sun and Dearborn rivers, and in the vicinity of the pass, curves adopted to secure the proper gradients. Without being certain of the point, I think it would be safe to estimate that the tunnel would have to be cut through a formation of which fifty per cent. is a rock of clay slate.

Our observations show that the Blackfoot fork, down which we travelled, descends at the rate of thirty feet per mile. Making a due allowance for errors, I estimate that the railroad could descend for the first thirty-six miles with a gradient of forty-five feet per mile, and for the remaining distance, to the valley of the Bitter Root, with one of thirty-five feet per mile. In the last ten miles of the thirty-six, four sharp curves would be necessary; but the location could be so made that neither would require to have a less radius than two thousand feet. At our camp of the 24th and 25th of September the valley of the Blackfoot fork becomes enlarged, the mountain spurs receding off either side to a distance of six or seven miles from the stream; the intermediate space has a gentle slope connecting the bases of the mountains with the stream. Mr. Tinkham reports that this valley could be favorably connected with the summit between it and the tributaries of the Flathead river. I think that further examinations might establish a very good connexion by this route with the valley of Clark's fork. For a line down the Blackfoot fork, there would occur two curves of the minimum radius before reaching the valley of the Bitter Root. The last twenty miles are through a defile, where there would be about twenty-five per cent. of rock-cutting; the rock being a kind of limestone, which appeared to disintegrate rapidly by exposure to the weather.

In the event of Mr. Lander's report being adverse to the practicability of the line of the Bitter Root river, it seems to me that, with our present knowledge, the following is the best plan for making the descent into the valley of Clark's fork of the Columbia: Leave Hell Gate river at the mouth of the Blackfoot fork, and pursuing the hill-sides and the plateau which intervene, attain the summit of the first hill occurring between the Bitter Root and the Jocko. This, as our observations indicate, could be accomplished with a gradient of thirty-five feet per mile: to allow for errors, I estimate it at forty feet per mile. Having attained the summit, strike a tributary of the Jocko, which is adjacent to the present trail, and descend along its banks and those of the Jocko to the valley of the Flathead, and so to that of Clark's fork; which name I here propose to apply to the stream below the junction of the Bitter Root. The descent to the valley of the Jocko could be made with a gradient of forty feet; this grade is assumed at fifty feet. Hence, to the junction of the Bitter Root with the Flathead, it would be one of twenty feet. Another plan for passing from the Blackfoot to Clark's fork has been already alluded to. It is that which is referred to by Mr. Tinkham. If it should prove to be as favorable throughout as is supposed, it would be by far the preferable plan.

The means of our observations indicate that the average fall of Clark's fork is about eleven feet per mile. I estimate that the railroad could descend with gradients of from fifteen to twenty feet per mile. As far as I can at present say concerning the location, I think the road, after passing from the valley of the Jocko into that of the Flathead, would follow the hills on the left of the stream to a point some miles above its junction with the Bitter Root. Then crossing the former, it would follow the right banks of Clark's fork as far as Big Rock; here it would cross, and. following down the left bank, would recross at the Cabinet. Then tunnelling the Cabinet mountains three hundred yards, it would continue on the right of the river to Lake Pend d'Oreille, and on the eastern side of that to its lower extremity.

As the lake is subject to high freshets, perhaps variations of fifteen feet from low to high water, it would be necessary to run the railroad above this, by keeping the sides of the hills, and in some instances by high embankments. A bridge half a mile long would be necessary for crossing the valley of Pack river.

I do not think there would be much difficulty in providing against the great freshets to which Clark's fork is liable. As for the lake, so for this, fifteen is about the difference of level between high and low water marks.

The tunnel at the Cabinet mountains would be through a formation of which fifty per cent. is rock, this being basaltic trap.

As regards the subject of construction west of the Rocky mountain summit, it may be remarked that the line passes, in nearly its whole extent, through fine forests, which would furnish an abundance of pine, of cedar of fine quality, and of fir and larch.

I saw no good stone for building. A locality on the Blackfoot fork not far from Hell Gate, "Big Rock," and the mountains on the right of Clark's fork for some distance below Thompson's prairie, would, however, furnish a great abundance, which would answer for ordinary purposes. The prevailing rocks appeared to be a limestone, a quartz rock, somewhat resembling the gold-bearing quartz, and the basaltic trap. Mr. Tinkham mentioned that not far from the Hudson's Bay Company's post, among the Flatheads, a great quantity of good limestone for building could be obtained. Not far from the lower end of the lake I think it would be advisable to mark the crossing of Clark's fork.

Should it be desirable to carry the railroad by Fort Colville, I may here state that Lieutenant Arnold reports but one obstacle on the route he followed, and refers to a way by which that can be avoided. The transit from Clark's fork to the Sponkane could be made with gradients of not more than twenty-five feet. It might be facilitated by making use of the valley of a small stream which empties into Clark's fork at about twelve miles below the lake, and of a valley seen by us ten miles west of Clark's fork, and which appeared to make into Cœur d'Alene prairie. A further examination is necessary to establish that the connexion could be made in this way. And if so made, a considerable deflection from the line of direction of the road would be required.

The remainder of the distance to Wallah-Wallah could probably be accomplished with gradients of thirty-five feet to the summit between the Spokane and Lewis's fork, of thirty feet from that summit to the crossing of the latter river, and of twenty feet thence to Wallah-Wallah.

From the barren nature of this portion of country, the supplies for construction would have to come from the mountains to the east, and the valley of the Columbia to the west. From Fort Benton to Wallah-Wallah the distance is six hundred and fifty miles. In a direct line it is four hundred and six miles.

The difference of level between the two points is about one thousand nine hundred feet. From the Rocky mountain summit to the Spokane river the location of the road can be more definitely decided upon than elsewhere on the route. Within these limits the most important curves are six which would occur in the first sixty miles west of the pass, and one that would be necessary not far above the junction of the Bitter Root river. These will be of from two to four thousand feet radius. The great deflections from the direct line are, that to the south by way of the Blackfoot, and that to the north by way of Clark's fork. The first could be reduced, if a good pass and route should be found at or near the head of the Jocko; the second, by pursuing a more direct route from the lower crossing of Clark's fork to Wallah-Wallah. It will be seen, by examining the profile, that one hundred and twelve miles of the route—that is, from the summit between the Teton and Sun rivers to our camp of September 24 and 25—are at an elevation of between four and five thousand two hundred feet above the sea. One hundred and twenty miles—that is, thirty-two miles from the high prairies opposite Fort Benton to the summit west of the Teton, and eighty-eight miles from the camp of September 24 to that of October 6—are at an elevation of between two thousand eight hundred and four thousand feet above the sea. Three hundred and forty-nine miles from the camp of October 6 to that of November 2, are at an elevation of between fifteen hundred and two thousand eight hundred feet; and sixty-nine miles from the camp of November 2 to Wallah-Wallah, are from three hundred and thirty-eight to fifteen hundred feet above the sea. The dividing ridge of the Rocky mountains was, where we crossed it, six thousand and forty-four feet above the sea; a discussion of the observation on which this depends will, however, probably show that the result is too great. The estimates I have made for gradients depend on the barometrical observations.

This instrument, from the variations it exhibits when observed at different intervals at the same place, cannot be perfectly reliable when but one is used on an extended line; so that the estimate may, on a detailed survey of the country, prove to be considerably erroneous.

I have to transmit herewith a report from Lieutenant Arnold, on the route he followed to Fort Colville, and one from Mr. Tinkham, giving an account of a reconnaissance made by him in connexion with this portion of the survey. Mr. Lander declines reporting to me on the railroad results obtained by him. As you are conversant with all the circumstances of the case, I have to request, that with reference to any report he may render you touching this portion of the survey, you adopt such course as you may think proper.

I am, sir, very respectfully, your most obedient servant,

A. J. DONELSON,
Second Lieutenant of Engineers.

Governor I. I. Stevens,
Chief of the Northern Pacific Railroad Survey.

REPORT OF A. W. TINKHAM, GIVING THE RESULT OF EXAMINATIONS AS TO A CUT-OFF FROM THE BLACKFOOT TRAIL TO CLARK'S FORK.

Olympia, Washington Territory,
February 18, 1854.

Dear Sir: As a precautionary measure to secure the safety of my note-book on leaving Wallah-Wallah for my recent passage of the Cascade range, I committed to the charge of Wilson all notes and papers which I had with me, with instructions to proceed to this place by way of Columbia river, anticipating his arrival here considerably in my advance. As he has not arrived, I am stripped of the means of making a report to you of the several reconnaissances conducted under your direction, other than such general reports as I can make from recollection of the country traversed, and of impressions at the time.

A previous reconnoitring tour had enabled me to determine a very favorable railway route from the departure from Milk River valley, crossing Marias river, passing north of the "Knees," and, with admirable facilities, continuing along the high prairie neighboring on the Teton river. This location of the line through this section essentially coincides with the result of Mr. Lander's reconnaissance.

I parted company with you on Monday, the 19th of September, with instructions to proceed up Sun river to such a point as should connect its valley with the previously determined favorable railway line, and then to join you at Dearborn river, or to overtake you should you first reach that point.

I continued up Sun River valley to the forks of the river. In this vicinity, and leaving altogether the broken ground which the train passed over after leaving Sun river, I found the desired facilities for connecting the railway line with the line east. Sun river continues to have a broad and open valley, and near the forks, where I propose the crossing of the valley, the country slopes off gradually from either side of the stream, and affords a fine opportunity for an easy passage of the river, and for making ground in the approaches to the mountain pass already near by. The passage of the railway line here brings it into favorable position with reference to the ascent to the pass. The high, smooth plain south of the south fork of Sun river, which the line here attains, has an elevation of about 4,500 feet, and, as near as I can judge at this time without my notes, about fifteen miles distant from the pass. The entrance has an elevation of about 5,000 feet, leaving to be gained of ascent only five hundred feet; so that, were it possible to unite the pass with this plain by a continuous grade, the approach would be remarkably easy. Between us, however, and the pass, flow the tributaries of Beaver creek, cutting the ground in deep ravines, and preventing a regular gradation for the interval remaining to the pass. The best approach which, with my present knowledge, I feel justified in declaring practicable, is with about eight miles of sixty feet grade, tunnelling the summit in the ravine to the right and to the north of the trail, thus shortening the tunnelling distance, and perforating the mountain at about the elevation of 5,000 feet, and with a length which I estimate at four and one-quarter miles. In making the eastern approach, the line must not drop down into the valley of Dearborn river. The western descent, with a tunnel of four and one-quarter miles, can probably be accomplished with a forty-foot grade. I ought to have spent more time on this summit, but having been separated from my party, and being without food, and supposing that your careful examination would render it unnecessary, I hastened down the valley to overtake the parties ahead, joining you the next day, after making the passage of the summit—Saturday, September 24. I may state here that an observation made by Wilson while on the summit, gives as its height 5,537 feet—a result much lower than that given by the barometer at the time of your passage of the divide. It is not unlikely that the true height is between these two results.

On Monday, the 26th of September, I again left you, with instruction to take a trail connecting the valley of Blackfoot and Jocko rivers, and note its practicability as a railway route. The information which had been obtained from the guide Antoine was, that there was a good trail connecting these valleys, and that there was no connecting trail leading to any other locality. I found no trail until early on the day after leaving you. My barometer, from leakage, became useless that same night; and from having been led astray by the trail which I followed, and having now before me no record of my notes, I feel able to give little reliable information as to this region. My trail, however, finally led me into a fine, wide valley, walled in on either side by high mountains of singular boldness and beauty, which I descended, until soon I got so far into the valley that there was no getting out of it, and my only chance was to go ahead, which I did for several days, the valley continuing to retain its wide and favorable character, until, by the guidance of some Kootenaies Indians whom I fell in with, I was led to a trail which forked from the valley trail, and passed over the mountains to the left or the southwest side. My animals had become very tired from working through fallen timber, missing the trail, &c., and more especially as the valley was wooded and furnished a scanty supply of grass; and before attempting the mountain trail I halted for a day of rest, on Sunday, the second day of October. The mountain trail consumed a day and a half or near two days before I struck into the plains on the southwest side—a wide, open prairie valley, in which is a small trading-house of the Hudson's Bay Company, and which valley is very near to, or is connected with, Clark's fork. Jocko river is separated from the valley by only a small ridge; and on the fifth of October, at night, I encamped in the immediate vicinity of your last camp on the same river a few days after. The valley, which I followed for several days between the mountain ridges, appeared to reach into Flathead lake. It is wooded, and has growing in it a great deal of straight and valuable pine timber; has a great deal of gravel plain; and were it not that I conceive it to be too much out of the way, running too far north, it would make an admirable link in our railway line; its magnetic course is about north 45° west. Between this and the Jocko river there is another river, and the view of its valley which we had from near the small trading-post of the Hudson's Bay Company is very prepossessing. It is open and grassed; wide, with a gradual rise.

The summit of the stream which I followed into the mountains is also the summit of another stream, which is probably the one that came out at the trading-post, or else may be the Jocko river. If it should prove to be the former, it is probable that there is a highly favorable line of connexion through here from Blackfoot river to Clark's fork, promising better than the Jocko river. This summit I estimated could be easily attained, with a forty-foot grade, from the large plain where we encamped on Sunday, 25th September. It is not a ridge, but a flat, or almost a flat, with a sluggish beaver-dammed brook running through it, sometimes almost motionless. It is very likely that the trail forked here; but although I searched for it for a considerable time, I could discern no crossing of the stream, and no certain indication that there was a division of the trail.

The approach to this summit is so easy, that I am encouraged to believe that a railroad line will be obtained here which shall avoid the difficulties near Hell Gate, and the summit between St. Mary's and Jocko river.

I regret that I am not able to speak more positively on this matter. The route which I really followed I considered to be every way practicable, but I think it goes altogether too far north, and that it leads to Flathead lake, although of this I am not certain. It may be worthy of remark that, in crossing over the mountains towards the British trading posts, there was a vast amount of the finest limestone suitable for building, and lying in large square blocks, and stratified.

Very respectfully, your obedient servant,
A. W. TINKHAM.

Lieutenant **Donelson**,
Corps of Engineers, Olympia, Washington Territory.

EXTRACTS FROM MR. F. W. LANDER'S REPORT OF FEBRUARY 15, 1854, TO GOVERNOR STEVENS, GIVING THE RESULTS OF PERSONAL EXAMINATIONS, IN CONNEXION WITH THE RAILROAD SURVEY OF LIEUTENANT DONELSON FROM FORT BENTON TO WALLAH-WALLAH.

My own examinations extend through Lewis and Clark's Pass, and were abandoned at a point seven and a half miles west of the summit of the pass.

From the rapid descent from this pass towards the west, I was led to give my attention wholly to the line extending west from Cadotte's Pass. My examinations upon the line of Cadotte's Pass commenced at a point sixty miles west of the summit. (Mr. Lander's route was in fact along the valley of Hell Gate river.)

The ascent to Lewis and Clark's Pass can be made at forty (40) feet per mile. The minimum curvature adopted in the approach is of fifteen hundred (1,500) feet radius. The tunnel is two and three-fifths miles in length. Grades should descend from the eastern orifice of the tunnel towards the west, in order to reduce inclination.

The grade in descent towards the west is forty (40) feet per mile for about seven and a half miles; minimum curvature, fifteen hundred (1,500) feet radius; from the point seven and a half miles west by the present reconnaissance, a steeper inclination must be adopted. I am of the belief that gradients of fifty (50) feet per mile can be secured.

My own examinations have been upon a line through the valley of the Blackfoot fork [Hell Gate river] and Bitter Root river, and Clark's fork of the Columbia, passing south of Lake Pend d'Oreille to the lower extremity of that lake, and thence in a southwesterly direction to the Great Plain of the Spokane, thence by the northern bank of the Peluse to the northern branch of the Snake, thence to the Columbia. (Mr. Lander's route left the Blackfoot river some distance down the trail, crossed the mountain spurs to the south into the valley of Hell Gate river, and then followed that river down. The railroad practicability, therefore, of which he speaks, is of a portion of the Hell Gate, and not of the Blackfoot trail. Hence, whenever Mr. Lander speaks of the Blackfoot trail, he must be understood as really describing the Hell Gate valley; and Hell Gate will accordingly be substituted in brackets for Blackfoot.)

From the point where my own examinations commence, the general descent of the Blackfoot

[Hell Gate] valley does not exceed forty (40) feet per mile. The width of the valley is such that, by using curvature of twelve hundred (1,200) feet radius, at a few sudden changes of direction, the line need not make crossings of the stream; or should larger radii seem preferable, the character of the route may still be preserved, the river crossed at right angles to the current, and a reasonable length of straight line secured between the changes. The cost of all the bridging upon the division will be excessive, from the scarcity of the proper material for masonry, the basaltic rock of the section being unfit for such structures.

Should the line keep the northern bank of the river, an embankment formed of rock and earth by borrowing would avoid many deep ledge cuttings, and could be protected from the danger of sudden freshets by placing the weightier material upon the outer slope. For a portion of the distance through this valley, however, it will be necessary to make several crossings of the stream at high cost. The general grade down the Blackfoot [Hell Gate] fork of forty (40) feet per mile will probably be broken by the severe work, and lead to the location of steeper inclinations.

The descent of the Bitter Root is very severe. The general grade of the river valley for that distance is not great, but the changes in level are abrupt; the valley extremely narrow and crooked; sharp curvature and steep gradients will be needed under any system of location, and, by the best mode of conquering these difficulties, the line will be extreme in cost and nearly impracticable.

Many crossings of the stream are made; deep rock-cuttings occur, and all embankments must be thoroughly sustained against the effects of the rapid current and the danger of sudden freshets.

From the junction of the Bitter Root and Clark's fork to the crossing of Clark's fork, below Lake Pend d'Oreille, the line assumes a more favorable character, and although still severe, may be readily adjusted to reasonable rate of curvature and grade. The crossing of the summit section between Lake Pend d'Oreille and the valley of the Spokane is very favorable, and can be made upon gradients of forty (40) feet per mile.

All great difficulties of location upon the route, as delineated upon the sketch, cease at the valley of the Spokane, and choice can be made of several practicable lines to the great valley of the Columbia.

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19. REPORT OF MR. A. W. TINKHAM, ASSISTANT ENGINEER, AS TO THE RAILROAD PRACTICABILITY OF THE LINE OF THE MARIAS PASS OF THE NORTHERN LITTLE BLACKFOOT TRAIL, AND OF THE SOUTHERN NEZ PERCES TRAIL.

WASHINGTON, D. C., *July* 19, 1854.

SIR: On the 7th of October, 1853, in the valley of the St. Mary's river, I received from you instructions to examine Marias Pass, to return to Fort Benton, and again from that post to travel westward, crossing the Rocky mountains by such pass as shall be expedient, and the Bitter Root mountain by the southern Nez Perces trail, to Wallah-Wallah.

Three days later, having rested my animals, I left the last camping ground made by Lieutenant Donelson with the main train on Jocko river, and travelling northwardly, followed Jocko river to its mouth, and then journeyed up the valley of Flathead river. Until near Flathead lake, the valley of this river continues wide, grand, and bordered by partially-wooded hills. Most of this land is capable of occupation and settlement. The river is a fine, clear stream, one hundred to one hundred and fifty yards wide, occasionally fordable, swift current, and is estimated to have a descent of about ten feet per mile. About ten miles before reaching Flathead lake we leave the river and pass out of sight of it, and its issue from the lake could not be ascertained. The trail wound around the western shore of the lake. Its edge curves sharply and often, winding around the woody and rocky hills rising from the waters. The lake itself is a sheet of water of great beauty, some twenty-five miles long, and six or eight broad; is adorned with a number of picturesque islands rising some three hundred feet above the water; and on its west and east sides is shut in by dark wooded hills, or, on the east, more properly mountains. The east side has not been explored. Its exploration is desirable to show the entrance and issue of Flathead river, its character as a travelling or railroad route, and to ascertain which rivers enter it from the mountains from the east, indicating if there exist any chances of passage of the mountains from the head of the Teton and southern branches of the Marias to the valley in which is Flathead lake. At the foot of the lake is a small green prairie of good soil—a dark soil, with mingled fragments of trap-rock and gravel. At the upper end of the lake is a comparatively level and considerably extensive district, inviting settlement. In the immediate vicinity of the lake it is prairie; further from the lake it is diversified with woodland and prairie. Its limits are not known; it is six miles or more in width near the lake, and is apparently as much as twenty miles in its greatest width. The limit to its length was not seen. It appeared to extend in a northwest direction for upwards of twenty miles. A brook, forty feet wide and one foot deep, a tributary to Flathead river, flows through it. The general valley of Flathead river and lake, including the valley where the Hudson's Bay Company's small trading post is, I consider as one of the most desirable for settlement, having much fertile soil and wooded lands, with all the other desirabilities of good wood and timber, pure water and air, and agreeable locations. Residences on the lake will be most agreeably situated, for attractive scenery and advantages of water communication are of considerable extent. The river abounds with fish, mostly salmon and trout, and the lake is probably also well supplied with them. The hills which border the western side of the valley of Flathead river apparently retire at the upper end of the lake, and the only place promising an opportunity to pass from the valley directly westward is at the open spot, northward of the lake, described above. A few miles north of the lake we again fall into Flathead river. This river is ascended to its forks, about forty-two miles above the lake, and the trail then follows up the most eastern fork. At twenty-eight miles from the lake the wooded mountains close in upon the river and trail. To this point the valley continues wide and open, with a slight fall towards Flathead lake, and the river for this distance is very similar to what it was when first seen. Here it was one hundred yards wide, two and a half feet deep, clear, pebbly bottom, banks sixty feet high. After first closing upon the river, the mountains again retire, and there is a further nearly level, though wooded, basin for some fourteen miles. At the upper end of the basin the river forks—one fork coming from the northward through a straight and promising valley, and one from the east. On this route is the trail leading to Marias Pass. There is very likely a trail up the other. Beyond the fork the stream is walled in by high precipitous mountains, whose gray, naked peaks, in bold relief, rise from dark masses of fir and pine below them. The valley is narrow and always wooded; the trail is sometimes laborious and difficult, and grass for camping is always scarce, and so continues until the summit is passed. The divide of the Rocky mountains at Marias Pass is seventy-eight miles from the head of Flathead lake. In the last seventeen miles the valley rises rapidly; several small falls—one of about one hundred and forty feet rise—break the flow of the stream, gradually losing its tributaries and its volume; and besides the comparatively narrow ridge with which the valley abruptly terminates in the seventeen miles, the ascent is 2,170 feet; the divide at its lowest point is still 2,160 feet higher, and is 7,600 feet above the sea. A bare, rocky, circular ridge closes the valley, over which the trail crooks and winds, and is often just wide enough for the feet of the horse. It is wholly impracticable as a wagon pass. The passage of the summit was made on the 20th October; the air was chilly and the snow flying. To this time we had enjoyed fine, clear autumnal weather; as we rose in the valley, getting frost, and finally ice, in the night. Dropping down some 2,000 feet into the valley on the eastern side of the divide, where heads one of the tributaries of Marias river, we passed those small lakes or ponds, clear and cold, on whose shaded borders the snow-banks of the previous winter were still resting. The contrasts in the growth of the trees on the west and east sides of the mountains are very noticeable. On the west the trees continue large and thrifty almost to the summit. On the east, what little growth there is consists of short, scrubby pines, only suitable for fuel. On one of the snow-bordered ponds we camped.

Before the close of the day the snow was gathering on the ground, and continued falling until next day. When at a distance of only about a dozen miles from the summit we made the prairies, covered with some four inches of snow.

Smooth, dry prairie extends hence to Fort Benton; in traversing which to that post, we cross the tributaries of Marias and Teton rivers. This prairie is very sparingly supplied either with water or wood, but the soil appeared to be of fair quality, and, near the mountains, very good. The distance from the summit to Fort Benton is estimated at 136 miles, and the week spent in accomplishing this distance was a time of excessive cold, severe for the latter part of October; and it is probable that so cold weather did not occur again until considerably later in the season. One or two snow-storms occurred during the earlier part of the week, and in two instances the extreme cold reached as low as 3° above zero, Fahrenheit. The snow on the prairies had a greater depth of five inches, and disappeared altogether one day's journey out from Fort Benton. The weather had not been so cold there as on the prairies to the north and west.

On November 1st we left our camp opposite Fort Benton on our westward march to St. Mary's village. After several days of clear and mild weather, the air had again become cold, and we were visited with another snow-storm. For about seventy miles our march lay along the south side of the Missouri—sometimes in sight of it, and sometimes losing it for the whole day. We travelled slowly; our animals were worn with their previous work; and the week spent in making but little more than this distance was cold and snowy, the thermometer in one instance ranging as low as 3° above zero, and the snow once becoming as deep as eight inches. The air was often thick with snow, so that I could get but very limited and imperfect views of the country; and though passing within hearing of the Falls of the Missouri, I could get no view of them. Game was generally plenty. A few buffalo, and a good many elk and deer, were feeding on the prairie. The air resounded with the cries of the continually-passing flocks of swan, geese, and ducks; and near our different camps great quantities of these fowl would be found on the river, swimming among the floating ice moving down with the current. The ground was a good deal broken with coulées in the first half of the distance named, but above the falls marked changes occur in the valley of the Missouri; the river no longer flows in a deep channel, whose banks are again cut with deep coulées, but the river appears raised more nearly to the level of the surrounding country, and, in place of the bluffs, broken with coulées, grassed, and more or less irregular slopes, from which the trap for the first time is beginning to show itself, reach down to the river's edge. For most of the above distance the soil is good, often rich and black in the valleys.

At the end of the seventy miles, the traps, rock hills, and precipices crowd upon the river, and it was with great difficulty that we could get along in its vicinity. Here, I judge, is the so-called "Gate of the Mountains." I may here say that, immediately prior to our leaving Fort Benton, the disposition of the Blackfeet to waylay and murder our Pend d'Oreille guide had led to a change in our intended route; and then, finally, the floating ice in the Missouri made the fording of the stream dangerous, so that our guide did not think it safe to follow the usual and best route. In this way we got forced in among the turbulent mass of irregular and rocky hills, through which, for over twenty miles, lay our travelled route, the river winds its way; and where almost perpendicular precipices, obtruding at frequent intervals into the river's edge, make it impossible to travel along its banks. These hills are partially wooded with the pines. The principal difficulty in reaching the Little Blackfoot Pass is in getting through this broken region of country. A wagon route, I think, will be obtained here; probably there already exists a good trail—the continuation of a trail which we followed for some distance above the falls, and on which we probably should have continued, had not the ice with the high water prevented our making the passage in the usual place. Of this matter I cannot speak positively, not always rightly interpreting the signs of my Indian guide.

An interval of only about thirty-three miles lies between the broken, volcanic country resting on the Missouri and the summit of the pass by which I crossed the Rocky Mountain divide, entering the valley of a fork of Hell Gate river—termed by Lieutenant Mullan Little Blackfoot river. We were little troubled either with snow or cold after getting within forty miles of the summit of the mountains, the thermometer never ranging lower than 20° above zero, and generally much higher. The exact configuration of the pass I have given in my general railroad report. On the 10th of November I passed over, in company with a large troop of Pend d'Oreille Indians returning from the buffalo hunt. The ridge which constitutes the divide is a mere hill, up which, on the eastern side, loaded wagons can be drawn without serious difficulty; and the descent on the western slope is very gradual, and, for a wagon-road, all that is desirable. An inch or two of snow lay on the ground on the eastern side of the hill, and what little was on the summit was whirled into small heaps and drifts.

Following down the valley to its junction with Blackfoot river, as I estimated, about ninety-five miles from the summit, (much too small an estimate, according to Lieutenant Mullan's odometer measurement,) the valley is unusually favorable either for a wagon route or a railway. From the running water at the foot of the divide to Hell Gate, the valley, according to my estimated distances, has an average descent of twenty-two and a half feet per mile, (undoubtedly greater than the actual fall by several feet per mile,) is generally wider than Blackfoot River valley, is generally unobstructed by the woods; and, although the present trail in several instances for a few miles is steep and difficult when forced to the hill-side by the river, all these difficulties could be removed with a small amount of labor, or apparently avoided without labor sometimes, by taking the bed of the river for a short distance, (the river has a general depth of near three feet,) or by making river crossings.

The greater portion of this valley is a desirable region for settlement. The soil is often gravelly, as is the soil in St. Mary's valley, but it is fertile, and there are many agreeable and promising locations for farming, where a good soil, plenty of good wood sufficiently near for lumbering or fuel, pure cool water, good grazing, an agreeable and healthy climate, and a pleasing prospect, are inducements not often found united, and are sufficiently attractive to throng these mountain valleys at no distant day with a central population of vast importance, making in the heart of the mountains, and midway between the Missouri and Columbia, a central depot of supplies, a distributing point of labor and materials, and finally a region productive of valuable exports. I do not think there will be any essential increase of distance over the route by way of Blackfoot river from Fort Benton to St. Mary's.

I reached Hell Gate, near the river of Hell Gate, and Blackfoot river, on the 15th of November. In descending the valley the weather was generally mild, but still colder than what we experienced for nearly a month following. The mercury in one case descended as low as 12° above zero, but this was an exceptional case. We had several short squalls of damp snow, lodging for only a short time on the ground, and some little rain.

Turning up the St. Mary's valley, on November 17th I rested at Lieutenant Mullan's winter establishment, in St. Mary's valley, fourteen miles above Fort Owen; the weather mild and pleasant, and, during my stay there, occasionally rainy; the grass good, and the animals of the expedition, with the multitude of horses and cattle owned by the Indians and half-breeds, in the most thriving condition.

On November 20th, with a fresh band of animals, and renewed outfit of provision, &c., I was in camp, halting on the Sabbath, some nine or ten miles from Lieutenant Mullan, up the valley of St. Mary's river—a mild moist day, raining gently most of the day, with a temperature rising to near 50° above zero. About twenty-six miles from Lieutenant Mullan's winter post, and some sixty miles above Hell Gate, the St. Mary's forks to the southeast and southwest. Here we left the fine open valley characterizing the St. Mary's river, and tracing up the western fork, the wooded hills immediately closed in upon the stream; the valley narrowed until it was not over a quarter of a mile wide; patches of snow discovered themselves, and the air grew chilly. A few miles farther the snow was several inches deep, the streams were partially or wholly frozen; and when, on November 23d, about 24 miles up the valley from where we entered it, we left the stream near its source, there a brook only twelve feet across, the snow was still deeper; and a mile or two farther on, as we ascended the mountain divide, whose western waters are tributary to the Kooskooskia, the snow was two feet, and soon after two and a half feet deep. The passage of this divide was very laborious; is by the trail some twenty-five miles long, attaining a summit elevation of 7,040 feet, the trail keeping mostly on the open hill-tops, and with its ascent and descent, and the snow, gave us three days of hard labor, during most of which time our animals had nothing to eat. The snow at times wholly disappeared from the open southern hill-slopes, and had a greater depth of three feet. Tributaries of the Kooskooskia are either side of this long summit ridge—can be discovered on either side. Their dark wooded valleys, making up to the heads of the streams of the St. Mary's fork, and a constructed road keeping the wooded valleys, would avoid the extreme elevation attained by the trail. The country is not promising, however, as a railway route; and the Kooskooskia valley, the only outlet through the mass of mountains still intervening between this summit and the Great Plain of the Spokanes and Nez Perces, is narrow, dark, and shut in by steep wooded hills. There is no good trail down its valley. With a precipitous descent of 2,000 feet the trail drops down to the bed of the Kooskooskia, which we cross at a level of 3,760 feet above the sea, and immediately turn again to the mountain on its opposite side, and wind up their steep projecting spurs and ridges. There was no snow in the valley of the Kooskooskia; the stream was thirty to sixty feet wide and two feet deep at the crossing. All this country is wooded mainly with pines, firs, spruces, and hemlocks. A few miles farther on we again entered the snow, and not over five or six miles from the river, on the 27th of November, were brought to a halt in snow about four feet deep; crossing the precipitous hill before us, after a week's delay in fruitless efforts to get our animals farther, we commenced on foot the balance of the journey, abandoning everything that could not be taken on our backs, and with snow-shoes made during the week's detention, and heavily packed, left the camp in the snow where our progress had been so abruptly arrested. The elevation of this camp is 7,250 feet, (as measured on the profile.) During our stay there the snow increased in depth to six feet. Hence to the water-base of the mountains is about ninety miles; but with our heavy packs, the very steep and laborious ascents, and our inferior snow-shoes, we were fourteen days making this distance; finally, on the 17th of December, emerging into the unwooded (save in the bottom) valley of the Clearwater river, a few miles above its junction with the Kooskooskia. The barometer was left at the snow camp, and the thermometer was lost soon after we left there. I estimated at the time that the greatest elevation attained was something over 8,000 feet above the sea. All of the route lay over high ground, probably very little if any of it so low as 3,000 feet, and then rising as high as 8,000 feet. We had, of course, a great deal of thick, misty, and snowy weather; at one time, gaining a high elevation, thrusting our heads through a chilly vapor to enjoy the bright sun, while the mountains and valleys below us were buried under a sea of cloud. The views which I did gain discovered mountains of remarkable sameness, most of them wooded nearly or quite to their summits; no sharply-obtruding peaks; few with their gray-brown ridges breaking the monotonous evenness of dark, rounded summits, and no open valleys, pleasant lakes, or mountain prairies, such as distinguish the main range of the Rocky mountains. In several instances the trail descended to the valleys of the small streams, and in all these instances the snow disappeared.

With a single exception—a sharp, exposed and elevated ridge, where the wind had drifted the snow until it was piled to the depth of probably ten feet—I found the snow nowhere deeper than at the camps where commenced the snow-shoeing and packing; it rarely exceeded three feet in depth, and in places there was more. The average depth for the whole mountain portion of the trail, from the head of St. Mary's fork to the western edge of the mountains, about 120 miles, would be less than two feet. In this elevated route, with the depth of the snow, there was a very remarkable and unexpected mildness of temperature. The temperature was never quite so low as the extreme endured on the prairies, and the weather was occasionally warm. The snow, as a mass, was damp, and generally more or less incrusted. Several small falls of snow occurred during the passage, and the trees and bushes were always heavily loaded with snow. There was but little high wind, and generally it was nearly calm, and, as I have already said, the air was for most of the time thick and misty.

A few miles from the mountains I found the Nez Perces Indians—remaining with them nearly a week. Their horses and cattle, with some young calves, were grazing in the river valley and slopes. The short grass of the river bottom was still bright and green. In the small gardens of the Indians, pea-vines, started from the seed of the summer crop, were several inches high, and the whole appearance of the valley was in contrast with the cold and snow of the mountains. A slight fall of snow occurred while I was there.

On the 30th day of December I reached Wallah-Wallah. The wooded country ends with the mountains, and then commences the great plain known farther north and west as the great Spokane Plain, and through which, in deep channels, flow the Clearwater, Snake, and Wallah-Wallah rivers, and other and smaller streams. There is a great deal of good land along the whole route through this section. The bottom lands of the Clearwater were to some extent cultivated by the Indians, and looked fertile—a dark, gravelly soil. Their corn was of good size and heavy; wheat of good weight. Corn, wheat, peas, potatoes, and melons, are produced by the Indians. The upland plains, where I traversed them, showed a good dark soil, exposing fragments of trap-rock, and were generally clothed with good grass, on which were feeding large bands of Indian horses. Mr. Craig, who lives on the Lapwai among the Nez Perces, about forty-five miles from the mountains, has about eight acres of land under tillage, with opportunity for extending his field as he pleases. Peas, corn, wheat, squashes, onions, potatoes, melons, &c., all thrive well here, and Mr. Craig spoke favorably of the productiveness of the soil. His field was on the river bottom, while the hills bordering on the river afforded excellent pasturage for horses, cattle, and goats. On the high plain between the Clearwater river and his house I found eight inches of snow, lasting only for a short distance. There was none on the Lapwai, and none thence to Wallah-Wallah. The Clearwater, Lapwai, Tokannon, Touchet, Wallah-Wallah, with other small streams tributary to Snake river, have a great deal of fertile, tillable land upon them, which, at an early day, will attract attention from its farming qualities. Most of these streams are scantily wooded. The wild flax, of good quality, is to be found in all this region.

Leaving the Touchet river and approaching Wallah-Wallah, we enter upon the sandy, wild-sage plain, in the midst of which that post is established. This post I reached just before New Year's day of 1854; the weather continuing mild, without snow.

I must, in conclusion, gratefully mention the members of my party: Pearson and French, who, from the snow-camp, attempted to regain the St. Mary's valley with the animals, and, as we have since learned, succeeded with the loss of but five; and artificers Wilson, Agnew, and Brocken, who, with me, crossed the Bitter Root mountain with pack and snow-shoes, and who maintained a steady cheerfulness under circumstances of reasonable apprehension, with unusual discomfort and fatigue

Our guide, Charleer, a handsome Nez Perces lad, showed himself to be thoroughly acquainted with the particular route we travelled, and was very faithful.

Much information in the power of a guide to impart is lost when he is such that your only means of communicating with him are by signs. It is always desirable, in similar explorations, to be able to converse with your guide directly or through an interpreter.

I am, sir, very respectfully, your obedient servant,

A. W. TINKHAM.

Governor I. I. Stevens,
Chief of North Pacific Railroad Exploration Survey.

20. REPORT OF DR. JOHN EVANS, OF HIS ROUTE FROM FORT BENTON TO THE LOWER COLUMBIA.

[This paper, sent from Washington Territory, where Dr. Evans was still employed in the field when the report of Governor Stevens was submitted, was lost on the route.]

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21. REPORT OF LIEUTENANT RICHARD ARNOLD, U. S. A., OF HIS ROUTE FROM THE MOUTH OF CLARK'S FORK, BY FORT COLVILLE, THE GRAND COULÉE, AND THE MOUTH OF SNAKE RIVER, TO WALLAH-WALLAH.

OLYMPIA, W. T., *February* 5, 1854.

SIR: In compliance with your instructions, dated October 23, 1853, I have the honor to submit the following report, accompanied with a map and profile of the route travelled by the party under my command.

Hearing of your arrival and departure from Fort Colville with Captain McClellan and party, I moved in advance of my command, then encamped about twenty miles from the fort, to learn if any instructions had been left by you that would conflict with those previously given by Lieutenant Donelson, U. S. A. Receiving the above named, I returned and marched my party to Colville, encamping on the east bank of the river, about half a mile above the fort. Before returning to my camp, I despatched an express to Pend d'Oreille mission with the letters, one to the reverend father, the other to Dr. Suckley. The latter one, by some inconceivable mistake, returned to me, but the other had the desired effect. The day after my arrival at the fort being a holiday, I was not able to obtain the necessary transportation for the river trip until the 3d of November. I then succeeded in hiring two canoes and four Indians. It was my wish to commence a series of barometrical observations at the 49th parallel, or thereabouts, to determine the fall of the river from that line to the ocean. The want of transportation prevented. I then had a series of observations taken at my camp near the fort. Leaving my camp at 2 p. m. on the 3d of November, I commenced the ascent of the river, taking one man to run the compass lines and take topographical notes of the country. The swift current, numerous small rapids, and many unforeseen accidents, made the ascent very slow, but at noon of the fourth day I arrived at a point about three and a half miles above the mouth of Clark's fork. Here I obtained an observation, the first since my departure from Colville; this placed me in latitude 49° 3′ 25″.9; thus showing a material error in the maps in my possession. This observation having been taken with sextant, may not be absolutely correct, but I feel confident that all future surveys will not find it far out of the way. I then embarked and run down with the current, passing through the rapid Little Dalles, and arrived at my camp on the 8th, having been absent five days and ascended the river thirty-five miles. The weather during the entire trip was very unfavorable. The second and third days after my departure, the snow fell to the depth of six inches, which made the travelling very uncomfortable, and it was with the greatest difficulty that I could keep my Indians from stopping. The view from Colville to Clark's fork was intercepted by mountain ranges, whose tops and sides, covered with snow, presented a barren and cold appearance. The remarkable similarity and unbroken lines they present, with the exception of the passes, through which the principal tributaries flow, taken in connexion with the country between them, enable me to take a general view of the entire trip. This narrow belt was level, with a gradual slope to the south, covered with timber and generally free from rocks. The soil near the camps sand, with some alluvium. The river in its meanderings divides it into alternate prairies from four to six miles in length, and one to two miles in width. The river has a rapid current, and is filled with innumerable small rapids. The rapid known as the Little Dalles is the only one that would impede navigation. A delay of half an hour at the upper extremity to repair canoes, enabled me to examine it. The river at this stage of the water had contracted to the width of about twenty feet; the sides solid rock. The current at this time very rapid, and at the highest stage of the water it is a perfect torrent. I made a portage along the east bank; the trail was good and about half a mile in length. Innumerable eddies and whirlpools are seen, which rendered the navigation in canoes rather precarious. The principal tributaries from the east, and the only one worthy of mention, was Clark's fork. This noble stream runs through a deep gorge in the range about a quarter of a mile from the main stream, and has two falls, one near the gorge and one at its mouth, and empties into the Columbia with a roar. The fall near the gorge is about three feet in height; that at its mouth fifteen feet, and not more than one hundred and fifty yards wide. I attempted to ascend the river, but after climbing over the rocks, was satisfied to obtain a view of the river where it debouches from the range. If the appearance of this pass is a fair illustration of its bank to the Pend d'Oreille mission, I believe the various reports circulated at Fort Colville true; to attempt to ascend with canoes, or move with a pack train along the banks, would be impossible.

The appearance of the country along the east bank of the Columbia, from the mouth of this tributary to within a few miles of Fort Colville, convinces me that the interval between these streams is a perfect network of mountains. About one mile north of Colville I saw a large stream; its direction, viewed from the river, was nearly north. Captain McClellan and party approached the Columbia by its valley. There is also another about six miles north of the Little Dalles; this is a mere rivulet, but at the time of high water it is a large and rapid stream. The main stream above Clark's fork was much larger than any tributary—has a swifter current, and is much deeper, but has the same general appearance. A pack trail passes along the next bank of the river. The mountain spurs present a great obstacle to a wagon road. Upon my return I received your letter of October 29th, authorizing me to leave before the arrival of Dr. Suckley, and to proceed along the east bank of Columbia to Fort Wallah-Wallah, by the Grand Coulée, provided the condition of the animals would permit. After a careful inspection, I was convinced that they required more rest. I consequently remained until the 13th. Astronomical observation taken at my camp, near the fort, determined the latitude to be 48° 38′. I cannot forget to remember Mr. McDonald for the disinterested and efficient service rendered on every occasion, and the hospitality extended to myself and brother during my sojourn near his pleasant post. On the eve of starting on the 13th, I heard of the arrival of Dr. Suckley and party; this, in addition to a violent hail-storm, induced me to accept the polite invitation of Mr. McDonald, and I quartered my party at the fort. Finding the Doctor could procure the necessary transportation for the river trip, I left the fort at 2 p. m. on the 14th, and marched eight miles. Leaving Colville the trail has a southerly direction, and passes over a well-wooded rolling prairie. A range of hills were at from one-fourth to half a mile distant during the entire day; they are from two hundred to three hundred feet high, and covered with a large growth of pine. The view to the west was intercepted by a high range of mountains running along the river bank; the soil good, sand and alluvium. About four miles from Colville I crossed a swift running stream, twenty feet wide and six deep. This stream is called Mill river, from the fact of the Hudson's Bay Company having a grist-mill near its mouth. The route of the succeeding day was without change. The hills have a gradual rise to the south, and the general appearance of mountains on the opposite bank the same. Passed a few lodges near the bank, and saw a number across the river. Their winter store of provision consists of salmon, which were seen in great abundance suspended from the limbs of trees. From the camp of the 15th the country was very undulating. The trail passed up hills and through ravines for twenty miles; it then had a gradual fall towards the upland, near Spokane, and passed through a steep sandy gorge to the river. The country between my line of march and the Columbia, which passed out of view about four miles from the trail, was very undulating, and rendered impassable by deep ravines. Passed three lakes along the trail; the largest, about twenty miles from the last camp, was three hundred feet long and one hundred wide. It had no visible outlet. Numerous small streams were passed during the day; timber is still found in great abundance. My guide having gone in advance to examine the river, found it too high to ford.

I then continued along the bank until within two miles of its mouth, where I found a few Indians, and encamped. Estimated distance travelled thirty miles. The late hour of camping delayed me until noon on the 16th, sending the observers to continue the survey, which was stopped about four miles from camp. I rode to the mouth of the river; at this point it was two hundred feet wide and very rocky: the high bank to the north has a gradual fall towards the river, while to the south it recedes, leaving a rocky flat, which is overflowed at the highest stage of the water. This stream flows far below the banks; has a rapid current and rocky bed: the banks were covered with fine timber, and the soil appeared excellent. After the Indians had crossed my party, I gave them about two feet of tobacco each, and they appeared well satisfied. They belonged to the Spokanes, and fully supported the good opinion I had previously formed of the tribe. The rest of the tribe were encamped farther up the river. From this point the trail passed along the bank, which was very steep, for a distance of four or five miles. At this height I saw the gorge through which the Columbia runs, and was able to connect the work of the previous day. The western bank still presents a barren appearance, and the range rises to the height of 1,000 feet. The trail then passed down the bank and continued along the river. I encamped near the Great Bend. The height to the south of Spokane is on a level with the Grand Plain, and although very undulating, may be regarded the same. From this camp I had a fine view of the terraces seen along the Columbia; they form the northern boundary of the Grand Plain. The night was pleasant, but a heavy mist along the banks prevented my taking any observations. The principal rocks seen since leaving Spokane are basalt, trap, and granite. Nearly opposite this camp the mountain range recedes, leaving a narrow strip about sixty feet above the river and ten miles in length.

Soon after leaving camp the Hudson's Bay trail passes to the south, and after a steep ascent it arrives on the Grand Plain; continuing over this, it enters the second coulée in size, (as seen along my route.) This is by far the best route. I followed an Indian trail along the banks in order to continue the rough survey of the river, and be able to enter the Grand Coulée from the river. This route enabled me to have the same view of the country. Until noon of the 19th the trail was along the northern slope of the plain, and very rocky and dangerous. The river to the north was impassable. I then arrived on the northern boundary of the Grand Plain; the view from this point was extensive; to the south and east could be seen a vast plain covered with a luxuriant growth of grass, but destitute of timber and underbrush of every description, except a cluster of trees near where the trail, previously spoken of, strikes this level; to the west, on the opposite side of the river, the general level is a prolongation of this plain, and covered with mountains, which rise as they recede from the view; to the north you have a fine view of the Columbia, and its steep rocky banks, around which I passed on my way to Spokane river. Continuing over this level half an hour, I again descended to the river by a steep and rocky trail, and marched three miles, encamping near the mouth of the coulée, about three miles from the camp of the 17th. I obtained a meridian altitude of the sun, which placed us in latitude 47° 58′ 51″. To give a description of the banks, as seen from this camp, would be nothing more than a repetition of what I have stated before. When within two miles of the mouth of the Grand Coulée, the trail again divided. One passed over a rocky bluff about two hundred feet high; the other continued along the river to the mouth of the coulée. To save time and distance, I conducted the train by the former, sending the observers to take particular observations after leaving the river. Timber, which was seen in great abundance to the Grand Plain, has gradually disappeared, and but few trees are seen along the river. The trail leaves the river to the north, and passes nearly south. After an ascent of two hundred and forty-three feet, we arrived upon a level which commands a fine view of the coulée; it was about ten miles wide at the northern entrance, and gradually widened until it passed out of sight; its walls were about eight hundred feet high, and one solid mass of rock, basalt cemented together by lava, or some more fusible rock. The trail had a gradual fall for about six miles, which gives a fair index of the ground included between the walls. At this point we came to a fine lake about sixty feet broad, which had no visible outlet. Soon after entering the coulée, I descried a mountain bearing N. 9° E.; its top was conical and covered with snow. I thought it was one of the highest peaks of the Cascade range, but an inspection of my maps leads me to believe that it was one of the snow-capped peaks far above the 49th parallel. From this lake the trail had a gradual rise to the south. This coulée was twenty miles in length; its walls then passed out of sight; to the west they followed a ravine. The soil was generally sand, except near the walls, where it was made up of disintegrated rock. Contrary to my expectations, I found the view from the camp as broad and extensive to the east as on the Grand Plain; but to the west it was intercepted by coulées. The line of march the succeeding day was very rocky for six miles, when we entered the second coulée in size. This coulée has the general appearance of the former. Travelling through this, we again entered the Hudson's Bay trail near a high rocky mound. To remove any doubt that may remain on the minds of others in regard to the Grand Coulée, which is laid down on the maps about ninety miles in length, I will state that I obtained the best guide in the country. He was born in this country, and has travelled the route for the last fifteen years. I questioned him very closely in regard to the route travelled by Lieutenant Johnson, in the middle of June, 1841. The coulée through which he travelled is not known as the Grand Coulée among the old residents. After leaving the coulée spoken of above, the trail has a gradual fall until it arrives at the bank of a stream. I then followed along this bank and encamped on the west side; this stream, which was ten feet wide and about two feet deep, was filled with large boulders, showing that it must have been a large and rapid stream. How far these rocks have been carried I am not able to state, but none were seen that would correspond to them in size.

After travelling a few miles, I crossed this stream and passed a fine lake, about six miles in length and one in width; it was fringed with alder bushes and filled with wild fowl—ducks, geese, and white swan. Along the eastern bank of this lake I again commanded a view of the range along the western bank of the Columbia as far north as the Pisquouse river. This view, taken in connexion with the information I have obtained from my guide, leads me to believe that the country bounded on the east by my line of march, on the north and west by the Columbia, on the south by a line passing through the mouth of the Pisquouse river and the southern extremity of the second coulée previously spoken of, is filled with coulées running in every direction, and ranging from one to fifteen miles in length. Leaving this lake, I travelled through drifting sand-hills for three or four miles; these sands continued westward as far as the eye could distinguish. I then entered a rocky valley and continued until nightfall, when I found a brook affording sufficient water for the animals and cooking purposes. Since leaving the Columbia the trees have entirely disappeared; the last seen were near the northern entrance on the eastern side: from this camp the trail passes over the plain, with a gradual fall. The gorge through which the river flows was in sight during the entire distance to this camp, and the plain before us and to the east. The approaches to the river are excellent from this point. I continued along the river to Snake river. The Yakima was very low, and, from the appearance at its mouth, I should not think it discharges more water than the Spokane.

The banks along Snake river, near the mouth and up the stream for at least a mile, are not over thirty feet, and in many places not exceeding ten feet high. Crossing this stream, I moved to Fort Wallah-Wallah, about ten miles distant. Arriving at this fort after dark, and on a dark and stormy night, I took up quarters in the Hudson's Bay buildings. Here, in accordance with your letter, I inspected the animals in charge of Mr. Pambrun; they were very weak and still unfit for service. I think they have regained sufficient strength to baffle the rigors of this season, provided the winter is not as severe as that of last year. The Indian horse spoken of in your letter had not been turned into the band. While at this post I succeeded in finding him; he was then put with the other animals, and a descriptive list left with Mr. Pambrun. As the country between this point and the Dalles, and from thence to Olympia, via Vancouver, had been travelled by the main party, I did not take any notes. After completing the duties at this place, I proceeded to the Dalles by land.

In view of a railroad line from Fort Colville to Fort Wallah-Wallah, or any point on the Columbia, I will state that there are no obstacles from Fort Colville along the river for twenty-seven miles; at this point the steep hills and steep bluff banks along the river offer a serious obstacle, and require a careful survey. Continuing on to Spokane river and the Grand Plain, the great fall to the river and the height of the plain are such as to affect the whole line, and may be to deflect it from its course. In consideration of this, I am in favor of the river bank. Following the river, there are no difficulties until you arrive at the great bend of the river. This part to the camp of the 19th, if not impossible, is certainly impracticable, involving not only steep side-cutting, but a sharp curve. This, then, will throw the line upon the high level. The limited time I had, and the lateness of the season, did not admit of my giving these portions so thorough an examination as they required. From this point, or the northern boundary of the plain, the country offers every facility so far as grades, but is destitute of timber. The approach to the Columbia along my route was good, and to the Yakima valley. This line could be deflected to the Columbia, at any point south of Pisquouse river, without incurring deep excavations or embankments; but I fear the approaches are unfavorable. From where my trail came to the Columbia, to Fort Wallah-Wallah, the country is level and sandy; the approaches to Snake river are very favorable.

Arriving at the Dalles, I turned over the animals and the bulk of the property to Mr. Martin. I also inspected the animals left at this place; they were in much better condition than those left at Wallah-Wallah, and will be able to enter the field in a few months. At this place I discharged my guide and packer. I then proceeded with the rest of my party to Fort Vancouver, and thence to Olympia, via Cowlitz river and Cowlitz landing.

The barometer used in my party was compared with one in the main party, at the time of leaving, with a view of another comparison at Olympia, as that instrument was broken in the field, and I had no standard to refer mine to. I have taken the mean of the observations taken at my camp at Fort Colville as the line of reference.

Finding you absent upon my arrival at Olympia, I turned the property over to Mr. Osgood.

Upon your return I had the pleasure of reporting in person.

I am, sir, very respectfully, your obedient servant,

RICHARD ARNOLD,
Second Lieutenant Third Artillery.

His Excellency I. I. STEVENS,
Chief of Northern Pacific Railroad Expedition.

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22. REPORT OF LIEUTENANT R. MACFEELY, U. S. A., OF HIS RETURN FROM FORT OWEN TO WALLAH-WALLAH.

FORT VANCOUVER, W. T.,
January 20, 1854.

SIR: In compliance with the request in your letter of the 4th instant, to furnish a report of the route passed over by me in returning from the St. Mary's village to this place, I have the honor to submit the following:

I commanded the escort which accompanied the expedition for establishing a depot of provisions at the St. Mary's village, from the Dalles until our arrival at that place on the 29th of August.

Not meeting at the St. Mary's village, as expected, the party under your command, it became necessary, in order to reduce as much as possible the expenditure of the provisions intended for your use, that all whose services could be dispensed with should be sent back. Accordingly, I was placed in charge of sixteen quartermaster's employés and ten soldiers, and ordered by Lieutenant R. Saxton to proceed with them to Fort Vancouver.

The route by which I was to return having been left to my own selection, I chose the one crossing the Bitter Root or St. Mary's mountains, known as the Nez Perces trail, believing that by this route I could reach the Dalles in less time than by either the route across the Cœur d'Alene mountains, or the one over which we had just travelled.

There being no Indians at this time in the neighborhood of the St. Mary's village, I was unable to procure a guide. I learned, however, from Mr. Frank Owen, that his brother had once travelled this trail, and that though much worse, it was at least one-third shorter than either of the others. Mr. Owen also kindly offered to accompany and show me where the trail entered the mountains.

After remaining a few days at the St. Mary's village to rest our weary animals and to dry some beef for our use, we set out on the 4th of September without a guide, map, or compass, and with but twenty days' rations, to find our way back by an unknown route to the Dalles.

My party consisted in all of twenty-seven men, and we had with us fifty-nine horses and one mule. The most of our horses were so weak and lame as to be totally unfit to undertake the long journey through the mountains.

Our course, as near as I could guess, for the two days after leaving the St. Mary's village, was nearly south; passing up the valley of the Bitter Root, and following that stream about forty miles, the trail entered the cañon or pass in the mountains.

The country through which we passed was moderately rolling; about one-fourth being covered with timber, and the rest prairie or open land. The soil of the bottom land is a brownish loam, mixed with sand-gravel; that of the upland contains less loam, and is not so rich, though yielding an abundance of good grass.

On entering the mountains on the third day, we took a nearly west course, following a small Indian trail which led through a deep cañon up the Nez Perces fork of the Bitter Root river, crossing and recrossing it very often during the day, the trail winding at first through open timber, which gradually became thicker as we advanced farther into the mountains. This stream, I was informed by Mr. F. Owen, is the principal fork of the Bitter Root; it varies in width from three to six yards, seldom exceeding two feet in depth. Its current is very rapid, and, like all mountain streams, it is clear and cold.

After following up this stream for about twenty-five miles, and encamping on it one night, we commenced the ascent of the mountains. The trail ascending for some time by a gentle acclivity, and winding round the edge of a precipice, became, as we continued to advance, more steep; in some places leading us across narrow shelves of rocks, and at others over a loose soil of sand and gravel, making it difficult and dangerous for our animals. In about an hour, leaving the edge of the precipice, we continued toiling up the side of the mountain, and after six hours' hard climbing reached what seemed to be its summit, but was in fact the brink of a deep and precipitous ravine, from the bottom of which rose a second slope, similar to the one we had just ascended. We descended by a steep and rugged path to the foot of this ravine, where we found a small spring. Stopping here about an hour to rest our animals, we were compelled, for want of grass, and in hopes of soon finding some, to set out again. When about half way up this slope, night coming on, we were unable to follow the trail, and finding no grass, tied up our animals to keep them from straying off in search of it; and having no water with which to prepare our supper, we turned in without it.

The next morning we started at peep of day, and not having eaten anything since the morning before, were anxious soon to come upon water, intending, when we did, to stop and get breakfast. Our animals were now so much exhausted from the fatigue of the last two days, during which time they had had nothing to eat, that I made all the men dismount, and informed them that they would have to walk until we got out of the mountains. Our road this day was similar to that travelled the day before, full of steep ascents and yet more precipitous declivities, and much obstructed by fallen timber. About 12 o'clock we arrived at the foot of a deep ravine, from the side of which issued a small spring, and finding a little grass in the vicinity, I concluded to encamp here. The spring was so small that we had to dig a number of little wells for the water to collect in, in order to obtain sufficient for ourselves and animals.

Three of our horses gave out this day and were left behind, and many of the others were so much used up, that it was with great difficulty that we got them into camp.

For eight days more we continued climbing mountain after mountain, our difficulties increasing as we proceeded; and when after much toil we had attained the summit of one of these mountains, it was only to behold another of still greater altitude rising in advance of us; and so it continued, day after day, until we began to think that there was no limit to them.

These mountains, unlike any that I had before seen, seemed to have no dividing ridge, but are an immense mass of mountains, broken into conical peaks and lateral spurs, and all thrown together and piled one upon another in wildest confusion.

Owing to the scarcity of grass we were unable to make regular camps—sometimes stopping three or four times during a day to allow our animals to gather the thin grass on the sides of the mountain, and frequently encamping at night without either water or grass.

We suffered a good deal from the cold, owing to the sudden transition to a high altitude. For several days we had to contend against rain, hail, and snow, which, by making the road muddy and slippery, kept both men and horses on a continual strain. Often the road was obstructed with large pine trees which had fallen and lay in every direction across the trail, making it almost impassable. On the summit of two of the mountains we found snow to the depth of three or four inches, and it was still snowing there, while in descending into the valley it changed into sleet and rain. At last, about noon on the 15th of September, we found ourselves on the summit of the last mountain, and beheld the Nez Perces plains spreading out in smiling verdure beneath us. The contrast between these vast plains, glimmering with reflected sunshine, and the cold and dreary region from which we first beheld them, inspired us with fresh energy; and, forgetting our fatigue, we hurried down the mountain, dragging our jaded animals after us, hoping soon to reach its base, where our animals would obtain food and rest. We soon, however, discovered that our hopes were not to be realized as soon as we had imagined, and that we had still a long distance to travel before reaching the plains.

About sundown we encamped in a little open prairie on the side of the mountain, where we found better grass than our animals had had since leaving the St. Mary's valley. There being no water here, at dawn of day we were again on the march, and, after travelling about five miles, came upon a small stream at the base of the mountain. Bordering on the stream was a large prairie covered with a luxuriant growth of bunch-grass. Here I concluded to remain a few days, as our animals were completely worn out and required rest; besides which, private Stevens, a soldier attached to the escort, having failed to reach camp the night before, I wished to send back in search of him.

This man had not been seen by any of the party since noon the day before, and I feared that some accident had happened to him. I therefore, immediately after encamping, sent two men back on the trail to look for him.

These men remained out all night, and did not return until the following evening. They found the saddle and bridle belonging to the lost man about fifteen miles back from our camp, but though they had built fires and shouted, and fired off pistols from every height, had seen nothing of him. They said that it had snowed all night, and that in the morning it was so deep that they had great difficulty in keeping on the trail.

In some places the snow had drifted, and was two and three feet deep. They had gone back to within a mile of the summit of the mountain, some distance beyond where the man had been last seen. I sent parties to scour round the base of the mountains, and to build fires, in order to attract his attention; but after two days' unsuccessful search I was compelled, in consequence of the scarcity of provisions, (we having but seven days' rations left,) to give him up for lost, and to proceed on our journey without him.

I have recently learned that this man, after wandering several days in the mountains, during which time his feet and hands were frozen, found his way to the plains, where he was discovered and taken care of by some Nez Perces Indians, who, after he had recovered sufficiently to travel, took him to Fort Dalles. He is now in the hospital at that post, and has not yet recovered sufficiently to be sent to duty.

It appears, from his statement, that his horse gave out, and in trying to get him along he got behind the train, and losing the trail in consequence of the snow which covered it, became bewildered, and was unable to find it again. When discovered by the Indians he was unable to walk, and in a famishing condition, not having eaten anything for fifteen days but a prairie chicken, which he killed with a stick.

On the morning of the 17th we started again, and in about two hours came upon a stream, which I supposed to be the Kooskooskia or Clearwater. This stream, where we crossed it, flows with a rapid current over a bed of pebbles, and is about twenty yards wide. Fording it, we came upon a deserted Indian camp. Here were the poles of discarded lodges, near which were several small gardens that had evidently been cultivated this season, and from the piles of hulls which I saw scattered about, I judged that peas had been the principal crop raised in them.

The trail which we had followed so far, here became broader and divided into two—one following down the Clearwater, the course of which at this place seemed to be nearly north, and the other taking off the left in a southwest direction. I hesitated for a few moments, not knowing which of these trails to take, when discovering some fresh tracks of horses and cattle on the one to the left, and the course of this one agreeing with that which I thought we ought to travel, decided me in choosing it.

On leaving the Clearwater, we wound our way up a steep hill, and continued to ascend by a series of gentle ramps, and at the end of about twenty miles came to the top of a ridge running in a direction nearly parallel to that stream. Between this ridge and the Clearwater, the country, with the exception of a few straggling pines, is destitute of timber, the soil of which, though dry and sandy, yields an abundance of fine grass. After crossing this ridge, until we struck the Snake river, we travelled through a beautiful country, alternating with open prairie and timber land, and intersected with numerous little rivulets, varying in width from two to six feet. The soil bordering on these streams is a dark loam, and afforded fine pasturage for our animals.

We travelled very slowly, not over fifteen miles a day, for many of our horses were so weak that they faltered and staggered as they walked.

On the morning of the 20th of September we came suddenly in sight of Snake river, running through a deep chasm with perpendicular sides a thousand or fifteen hundred feet below us; so that it looked like an inconsiderable stream.

Following along the edge of this chasm for several miles, we descended, through a narrow ravine about six miles in length, to the margin of the river, which we struck about twenty miles above the mouth of the Clearwater. Pursuing our course along the river for a few miles, we came to an Indian lodge, which was occupied by an old Nez Perce and his son. These were the first persons we had seen since leaving the St. Mary's village. Ascertaining from the old Indian that it was impossible to follow the river any farther on this side, I engaged him to cross us over in his canoe, and to accompany us as guide to Wallah-Wallah. As he had but one canoe, it was not until about one o'clock on the following day that we succeeded in getting everything safely across. Many of our horses were so weak that we had to swim them across by the side of the canoe.

The river here runs with a rapid current through a deep cañon with perpendicular sides, and is upwards of three hundred yards wide, and as clear as spring water.

For two days and a half we followed a narrow rocky trail down the course of Snake river. Sometimes coming upon rocky bluffs, rising perpendicularly from the water, we would wind our way in a zigzag course up their sides; sometimes passing along a narrow path, with a wall of rock on one side, and a yawning precipice on the other. In crossing one of these narrow ledges, one of our pack-horses losing his foot-hold, rolled five hundred feet down a precipice and was instantly killed. He was only prevented from falling into the river by coming in contact with a large rock.

As we proceeded down the river, the bluffs on either side became less steep and rocky, and gradually diminished in height.

We passed several lodges of Indians on the banks of the river.

About thirty-five miles below where we crossed it, our trail left the river and followed up the course of a small stream for six or eight miles. Leaving the stream, we ascended a succession of hills, and after travelling about twenty miles over a rolling, sandy country, (destitute of timber, but covered with a luxuriant growth of wild sage,) we descended a steep hill, at the foot of which ran the Two Canôn river. This stream flows with a gentle current, and is about six yards wide and two feet deep.

Crossing this river, our trail led us over a gently undulating country, and at the end of about twenty-five miles came upon a small creek, ten or twelve feet wide, called the "Touchet." Following along this creek about fifteen miles, we left it, and after a march of fifteen miles over a barren, sandy country, reached Fort Wallah-Wallah on the 27th of September.

On our arrival at this place we were completely out of provisions, and for seven days previous had been living on half rations. I obtained from the Hudson's Bay Company's post a supply sufficient to last us to the Dalles.

We remained at Wallah-Wallah two days to jerk some beef, and to allow our animals to recruit a little. We set out again, and taking the Columbia River trail, reached Fort Dalles on the 6th of October. Turning over the public animals and property in my charge to the quartermaster of that post, I took river transportation, and arrived at Fort Vancouver on the 10th of October.

I estimate the distance from the St. Mary's village to Fort Dalles, by the route which we travelled, to be between 450 and 500 miles. We were thirty-three days in accomplishing this journey. One-third of this time our route was over barren, rocky mountains, destitute of grass, which so weakened our horses and wore off their hoofs (they being unshod) that seventeen of them gave out, and being unable to travel, were abandoned. Besides these, we lost seven others—five of which strayed away or were stolen, and two were accidentally killed; one by falling down a precipice, and the other, getting entangled in his picket-rope, was choked to death.

The distance from the Bitter Root river (across the mountains by the trail which we travelled) to the Clearwater I estimate to be about one hundred and thirty miles.

The whole country from the St. Mary's village to the Dalles, with the exception of a few valleys on the Bitter Root and between the Clearwater and Snake rivers, is a barren, sterile desert, without a single redeeming property to recommend it.

In conclusion, I have to state that I received no instructions to make an exploration of this route; and as I took no interest in it, and kept no notes, I am unable to furnish you a more detailed report respecting it.

I am, sir, very respectfully, your obedient servant,

R. MACFEELY,
Second Lieutenant Fourth Infantry.

Governor I. I. STEVENS,
In Charge of N. P. R. Exploration, Olympia, Washington Territory.

G.

NAVIGABILITY OF THE COLUMBIA.

23. REPORT OF DR. GEO. SUCKLEY, ASSISTANT SURGEON, U. S. A., OF HIS TRIP IN A CANOE FROM FORT OWEN, DOWN THE BITTER ROOT, CLARK'S FORK, AND COLUMBIA RIVERS, TO VANCOUVER.

OLYMPIA, WASHINGTON TERRITORY,
December 19, 1853.

SIR: I have the honor to submit the following report concerning my operations while at the Flathead village of St. Mary's, and my subsequent reconnaissance of the Bitter Root, St. Mary's, Flathead or Clark and Columbia rivers, agreeably to instructions received from you dated October 2.

I had considerable difficulty in making a canoe which would answer the purpose. A skin-boat, made of three bullocks' hides, was at length constructed, and on the 15th of the same month I embarked, with two white men and an Indian, to descend the Bitter Root river. The inhabitants at St. Mary's were entirely unacquainted with the nature of the river and its capabilities for canoe navigation, no boats ever having been known to ascend the river higher than the Horse Plain, just below the junction of the St. Mary's and Pend d'Oreille rivers.

My trip being considered so hazardous, I was obliged to proceed with great caution, and it was not until the eleventh day that I reached the latter river. On the 25th day after my departure from St. Mary's I reached the Pend d'Oreille mission. My provisions had entirely given out, but, thanks to the kindness and hospitality of the good missionaries at that point, my stock was replenished. Here I found that the skin-canoe had become so rotten that it became necessary, in case I proceeded farther by water, to obtain a new boat. Owing to the miscarriage of some letters of instruction which had been sent to me from you, and from a wrong impression on the minds of the priests to the effect that they had heard of your having sent positive orders to me to relinquish the trip, I was reluctantly compelled to take horses and proceed to Fort Colville, on the Columbia river, distant sixty miles by land. The distance by the river may be a little more. It is my opinion, from what I could learn by observation and report, that I could have descended the Clark river to that point, although, of course, I should have been obliged to use great caution, as nothing definite is known by the Indians, or others, concerning this point of the river. I suppose that the river would be navigable by the Indians in their canoes, if there was any inducement for so doing. Their hunting-grounds lie in another direction, and they are too indolent to travel for the sake of exploring or for pastime.

On the thirteenth of November I arrived at Fort Colville, where I obtained further supplies, two canoes and three Indians.

On the seventeenth I again embarked, reaching Fort Vancouver on the sixth of December. On the route I stopped at Fort Okinakane, Fort Wallah-Wallah, the Dalles, and the Cascades, and obtained such supplies as I needed. The time occupied in making the whole distance was fifty-three days, or two days less than was occupied by the main train, under Lieut. Donelson, between the same points. The running time, exclusive of stops, was two hundred and eighty-five and a half hours, and the distance, (approximate,) as measured by the course of the rivers, including the greater and lesser bends, was one thousand and forty-nine miles. This will give the average speed of 3.674 miles per hour. There were but three portages on the whole route of any magnitude: one of thirteen hundred paces on the Clark river, above Lake Pend d'Oreille; one on the Columbia, at the Dalles, of eight hundred paces; and, lastly, one at the Cascades of one and a half mile in length. On the latter I made use of the wooden railway to convey the canoes and their loads. It should be borne in mind that this passage was made at the lowest stage of water, when the current was proportionately feeble.

The Bitter Root river was quite shallow in many places, and my canoe, which, when loaded, drew about ten inches of water, had frequently to be lightened. After reaching the St. Mary's—formed by the junction of the last-named river and the Hell Gate river—I always had sufficient depth of water. About sixty miles (by the river) below the mouth of the Hell Gate the mountains approach very closely to the bed of the stream, rendering its current very swift, and abounding in rapids. Farther down it is more straight, with large flats on one or both sides; channel deeper and current more sluggish.

At a point about sixty miles above the Pend d'Oreille mission (of St. Ignatius) is the Pend d'Oreille or Kalispelm lake, formed by a dilatation of the river; it is a beautiful sheet of water, about forty-five miles in length: below it the river is sluggish and wide for some twenty-six miles, where rapids are again encountered during low water. From a point nine miles above the lake to these rapids, a distance of about eighty miles, steamboats drawing from twenty to twenty-four inches could readily ascend. In higher water, of course, the distance would be lengthened. There would be but one bad obstacle between the Cabinet (twenty-five miles above Lake Pend d'Oreille) and a point ten miles below the mission, a distance of one hundred and forty miles. The obstacle alluded to is where the river is divided by rocky islands, with a fall of six and a half feet on each side. At this point a lock might readily be constructed. The Hudson's Bay Company's large freight-boats are in the habit of ascending from the lower end of Pend d'Oreille lake to the Horse Plains, a distance of about one hundred and thirty-five miles. This involves two portages. On the Columbia, between the mouths of the Spokane and Des Chutes rivers, a distance of about three hundred and fifty miles, there are but three bad obstacles to navigation for steamboats drawing from twenty to thirty inches. The principal of these are the Priest and Buckland rapids. These might probably be locked, or so modified by art as to render them passable by steamboats or other craft. The mouth of the Des Chutes river is about eight miles above the present steamboat landing at the Dalles. I have dwelt on these particulars, knowing how important they will prove in relation to questions of railroad construction and the transportation of supplies. From the Horse Plains before spoken of, *the river, so far as I examined it,* would be excellent for rafting purposes. Timber in this manner could be transported a great distance. Above this, to the St. Mary's village, I cannot give a decided opinion in its favor, but I am inclined to the opinion that rafts might be run—at any rate, logs could be readily driven down the current from an immense distance.

While on the subject of *timber,* I will briefly allude to its quantity and quality. Along the Bitter Root and Hell Gate rivers, and the mountains in their vicinity, the red pine and the larch, favorite trees in ship-building, are found in great quantities. Farther down these streams we find, in addition, cypress, cedar, hemlock, spruce, and fir, besides several hard-wood trees. The timber country extends from the main range of the Rocky mountains to a point about eighty miles below Fort Colville; from thence to the Dalles there is no timber. At the Dalles it again appears, and trees of many descriptions, and frequently of enormous size, are found thickly covering the valleys and surrounding hills. Good building-stone is found along nearly the whole route. There are a few pieces of excellent land along these rivers; their waters are clear and beautiful, and filled with thousands of fish of the different species of the salmon family. The country above the Dalles is remarkably healthy, (see medical report.) The St. Mary's valley, so called after the Roman Catholic mission which was here established, is situated between the Rocky and Bitter Root ranges of mountains. The valley at Fort Owen (on the site of the former mission) is about twelve miles wide. It is very fertile, watered by cool, sparkling brooks, and surrounded by lofty and picturesque mountains. It is inhabited by the Flathead or Selish Indians. How they obtained the name of Flatheads I am unable to say, as the custom of flattening children's heads is not practised by them. The men are rather below the average size, but they are well-knit, muscular, and good-looking. Although professedly Roman Catholics, they still keep up their aboriginal mode of dress, and many of their old customs. They are remarkably honest, good-natured, and amiable. On account of the depredations and constant aggressions made upon them by the Blackfeet, and their own migratory habits, it was found inadvisable to keep up the mission among them. It was accordingly abandoned three years ago. They still remember the good teachings of the missionaries, as evinced by their honesty and chastity. Although few in number, they are very brave, and invariably attack the Blackfeet when they meet. The custom of scalping dead enemies is abandoned by them. Owing to the incursions of the Blackfeet, who steal their horses, they have but a few good animals left—so few, that some are prevented from buffalo hunting in consequence. They raise some wheat and potatoes, but depend principally on the chase for subsistence. They have quite a large number of cattle; these they corral at night to prevent them from being killed by the Blackfeet. The latter Indians do not steal cattle as they do horses, but kill them out of malice. The brothers Owen purchased the mission buildings of the priests, and established a private trading-post. This is called Fort Owen. It is surrounded by the Flathead village, numbering sixteen wooden houses. The soil of the valley is exceedingly fertile. Cattle do not generally require foddering in the winter, the snows are so light. All the numerous streams abound in fine trout. Grouse in the valleys and on the mountains, bear, deer, elk, beaver, and mountain sheep, are abundant. Buffalo were formerly in great numbers in this valley, as attested by the number of skulls seen and by the reports of the inhabitants. For a number of years past none had been seen west of the mountains; but, singular to relate, a buffalo bull was killed at the mouth of the Pend d'Oreille river on the day I passed it. The Indians were in great joy at this, supposing that the buffalo were coming back among them. In addition to the foregoing, I collected considerable information respecting the missions, and the past and present condition of the Indian tribes on my route. Much of this is contained in my journal, from which I take the following extracts.

November 6, 1853.—Thirty-two miles below Lake Kalispelm. To-day, after paddling ten miles along the river, which is here about three-fourths of a mile wide, we got into swifter water and a quick succession of rapids. The nineteenth mile brought us to our last portage this side of the mission of St. Ignatius, (R. C.) Here an island blocks up and dams the river, which relieves itself on both sides of the island by a cascade of about six and a half feet perpendicular fall. In the middle of the island is a cleft, now dry, which becomes a third channel in high water. Below the island a bay makes in to within thirty feet of the water on its upper side. Over this thirty feet of rock we made a portage of our stuff, and dragged our boat across. I learn that about thirty-five miles to the north there is a beautiful sheet of water called Lake Rootham. It is about the same size as Lake Kalispelm, and, like it, beautifully clear, and surrounded by lofty mountains, but surpasses the latter in beauty by the great number of small islands it contains. The outlet of the lake enters Clark river about five miles above the fall. From Lake Rootham a mountain ridge runs south-southwest to the Spokane country, a distance of about seventy miles. The river and ridge intersect at the fall, the island between being wrought into its present shape by the continual action of the water. According to the accounts of Indians and hunters, with the single exception of the break in its continuity, produced by the river at this point, the summit presents an almost dead level, and would offer many advantages in this respect for a trail or a wagon road. This range is much lower than the others in its neighborhood, and is free from snow in the summer. The occurrence of a natural level for a distance of seventy miles may, in future, be turned to great advantage. The fall on Clark river, in all probability, affords one of the best natural sites for manufacturing and milling purposes that can be found anywhere. The island not only forms a mill-site of incalculable water-power, but it affords an unyielding and safe foundation, secure from damage during the highest freshet. In the neighborhood of the fall there is but little land suitable for cultivation. The soil on the craggy hill-sides is thin, and at present covered with a dense growth of heavy timber. After making the portages, we proceeded two and a half miles down the river and encamped for the night.

November 7.—Made an early start. Paddled nine hours. At dusk we encamped with some Indians, on the left bank of the river, about half a mile above the outlet of Lake Debeoy. There are four lodges at this place, all built after the fashion of the Sioux lodges, with the single difference that they are covered by mats of reeds instead of skins. These mats are made of rushes laid parallel and fastened together at the ends. For convenience in travelling, the mats are rolled into cylindrical bundles, and are thus easily carried in canoes. Our breakfast and lunch to-day consisted of camas roots and dried berries, a little flour and hard bread crumbs (our last) being sprinkled in to thicken the compound, thus making a somewhat palatable compound or mush, or gruel. This fills up the stomach, but does not allay hunger. Our provisions are out, the ground is covered with snow, and the sky obscured with clouds. The weather is excessively cold. Our tent is wet, as indeed it has been for a week or more. Our robes and some of our blankets are in the same condition; and, on the whole, our situation is quite uncomfortable. Under these circumstances, I concluded to lodge all night with the Indians. Our hungry stomachs were quite willing to partake of any hospitality they might offer in the shape of food. With these feelings I entered the lodge of All-ol-sturgh, the head of the encampment. The other lodges are principally occupied by his children and grandchildren. They provided us with dried camas and berries, also a piece of raw tallow, which tasted very good. Shortly after our entrance, All-ol-sturgh rang a little bell; directly the lodge was filled with the inhabitants of the camp, men, women, and children, who immediately got upon their knees, and repeated, or rather chanted, a long prayer, in their own language, to the Creator. The repetition of a few pious sentences, an invocation, and a hymn, closed the exercises. In these the squaws took as active a part as the men. The promptness, fervency, and earnestness all showed, was pleasing to contemplate. These prayers, &c., have been taught them by their kind missionary and friend, the much-loved Father Hoecken, (S. J.) He is stationed at the Mission of St. Ignatius, from which we are, I hope, but a few miles distant. The participation of the squaws in the exercises, and the apparent footing of equality between them and the men, so much unlike their condition in other savage tribes, appear remarkable.

November 8.—We ate some more dried berries and some dried fish for breakfast, and, after making our Indian friends some presents, pushed off in our canoe for the mission, which we reached after paddling seven miles. I walked up to the door of the mission-house, knocked and entered. I was met by the reverend superior of the mission, Father Hoecken, who, in a truly benevolent and pleasing manner, said, "Walk in, you are welcome; we are glad to see the face of a white man." I introduced myself and the men, and stated that I had come all the way from St. Mary's by water, after a journey, or rather voyage, of twenty-five days; that I was out of provisions and tired. He bade us welcome, had our things brought up from the boat, an excellent dinner prepared for us, and a nice room to sleep in, and treated us with the cordiality and kindness of a Christian and a gentleman. In these kindnesses the Reverend Father Mennettree, and the lay brother, Mr. Mageau, cordially took part—all uniting in their endeavors to render us comfortable and make us feel at home. From the Reverend Mr. Hoecken I have the following particulars concerning the mission and the condition of the inhabitants in its vicinity: The mission was established nine years ago; the whole country at that time being a vast wilderness. Its inhabitants were the Kalispelms. They lived mostly from the Pend d'Oreille or Kalispelm lake, down the Clark river, to this point; they speak nearly the same language as the Flathead or Selish Indians. Another mission (St. Mary's) was at the same time opened among the last-mentioned tribe. Between these two, in the vicinity of the Horse and Camas plains, on the Clark river, another band, calling themselves Kalispelms, has since been formed, of which Ambrose is the chief; this band consists of a number of floating and wandering families, composed of Spokanes, Kalispelms proper, and Flatheads, who, having intermarried, have formed a habit of sojourning at this locality during their annual migrations to and from the buffalo hunting-grounds. In all, the two bands of Kalispelms number about one hundred lodges—say sixty of the Kalispelms proper, or those who recognise Victor as their chief—and have their headquarters at the mission, and about forty of the new band already alluded to, who look up to

Ambrose, and who live above Lake Pend d'Oreille. The Flatheads number about forty-five lodges. These are not all inhabited by Flatheads, there being but very few pure Flatheads left, the race having been almost exterminated by the Blackfeet. The mass of the nation now consists of Kalispelms, Spokanes, Nez Perces, and Iroquois, who have come among them, together with their descendants. Pierre Baptiste, the old Iroquois at Fort Owen, thinks that there are about sixty lodges among the Flatheads, but says that many of them are only inhabited by old women (widows) and their daughters. For the first two years the missionaries lived in skin lodges, accompanying the natives on their periodical hunts and visits to their fishing-grounds, &c. During this time they found it very hard to live. Their food consisted principally of camas roots and dried berries, which at best contain but very little real nourishment. They raised some wheat, which they boiled in the beard for fear of waste—parching some of the grains to make a substitute for coffee. After this, they slowly, but steadily, year by year increased in welfare. Each year added a small piece to their tillable ground. They then obtained pigs, poultry, cattle, horses, agricultural implements, and tools. Their supplies of tools, seeds, groceries, clothing, &c., are shipped direct from Europe to the Columbia river. There are two lay brethren attached to the mission. One of these, Brother Francis, is a perfect jack of all trades. He is by turns a carpenter, blacksmith, gunsmith, and tinman—in each of which he is a good workman. The other, Brother Mageau, superintends the farming operations. They both worked hard in bringing the mission to its present state of perfection, building successively a windmill, blacksmith and carpenter's shops, barns, cow-sheds, &c., besides an excellent chapel, in addition to a large dwelling-house of hewn timber for the missionaries. The church is quite large, and is tastefully and even beautifully decorated. I was shown the handsomely-carved and gilded altar, the statue of "Our Mother," brazen crosses and rich bronzed fonts; work which, at sight, appears so well executed as to lead one to suppose that they all must have been imported. But no; they are the result of the patient labor and ingenuity of the devoted missionaries, and work which is at the same time rich, substantial, and beautiful. Works of ornament are not their only deeds. A grindstone, hewn out of the native rock, and moulded by the same hand which made the chisel which wrought it; tin-ware, a blacksmith's shop bellows, ploughshares, bricks for their chimneys, their own tobacco-pipes, turned with the lathe out of wood and lined with tin—all have been made by their industry. In household economy they are not excelled. They make their own soap, candles, vinegar, &c.; and it is both interesting and amusing to listen to the account of their plans, shifts, and turns, in overcoming obstacles at their first attempts, their repeated failures, and their final triumphs. The present condition of the mission is as follows: Buildings—the house, a good, substantial, comfortable edifice; the chapel, a building sufficiently large to accommodate the whole Kalispelm nation; a small building is attached to the dwelling-house—it contains a couple of sleeping-rooms and a workshop, a blacksmith's shop, and a store-room for the natives. These are all built of square or hewn timber. Besides these, there are a number of smaller outbuildings, built of logs, for the accommodation of their horses and cattle during the winter, and an excellent root-house. The mission farm consists of about one hundred and sixty acres of cleared land. Wheat, (spring,) barley, onions, cabbages, parsnips, peas, beets, potatoes, and carrots, are its principal products. The Indians are especially fond of carrots. Father Hoecken says that if the children see carrots growing they must eat some. Says he, "I must shut my eyes to the theft, because they *cannot, cannot* resist the temptation." Anything else than carrots the little creatures respect. The Indians are very fond of peas and cabbage, but beets, and particularly onions, they dislike. The other productions of the farm are cattle, hogs, poultry, butter, and cheese. Around the mission buildings are the houses of the natives. These are built of logs and hewn timber, and are sixteen in number. There are, also, quite a number of mat and skin lodges. Although the tribe is emphatically a wandering tribe, yet the mission and its vicinity is looked upon as headquarters. Until farms are cleared and properly cultivated by these Indians, their wandering habits must necessarily continue. Their migrations do not generally extend over a tract of country of more than one hundred miles square. The journeys are performed with horses and canoes. Many individuals of the nation prefer to use canoes entirely; these are made of the inner thin bark of the white pine, spread over red-cedar hoops, sewed with spruce roots, in the manner of the birch canoes of the Chippewas and other eastern Indians. The white-pine bark is a very good substitute for birch, but has the disadvantage of being more brittle in cold weather. These canoes are also shaped somewhat differently, not being turned up at the ends like those of the Chippewas.

Just above Lake Pend d'Oreille the Clark river divides into three streams, which again unite, thus forming two or three large islands. One of these streams is wide, shallow, and swift. Here the Indians annually construct a fence, which reaches across the stream, and guides the fish into a wier or rack, where they are caught in great numbers. To the natives this is a place of great resort. To Lake Rootham, long celebrated for the superior quality and vast numbers of its beaver, they go to catch the latter animal and to hunt deer. To other places they go to hunt deer alone; to others to cut flag and rushes for mats, and still again to others to hunt bear. The old method of cooking fish in bowls of wicker or basket work, heating the water by hot stones, is still occasionally practised; although the operation is not very cleanly, it is still very rapid, and the fish thus cooked have an excellent flavor. In summer the Indians live principally on fish, which they catch not only by wiers and fish-traps, but by the hook and line and by spearing. They also collect camas and bitter roots, and a berry, called in some of the eastern States the sugar-berry or sugar-pear. These they dry separately, and also in cakes, with moss, for winter use. This food affords nourishment merely sufficient to sustain life. In the autumn, in addition to hunting venison and bear, they dry meat and fish for winter use. When the severe cold weather has fairly set in, the whole band moves to some noted venison hunting-ground, where during the heavy snows the deer cannot escape, and are readily pursued and killed with clubs.

They hunt over the whole section so thoroughly as entirely to exterminate these animals in that locality, leaving none to breed. In this way they have destroyed the deer entirely in all but two or three places. To each of them they will proceed during the coming and one or two subsequent winters; the deer will then all be destroyed, leaving the inhabitants no dependence, unless by that time they shall have sufficient land under cultivation to support them; otherwise, there will be a great deal of suffering among these people. Last winter they killed eight hundred deer; these were but just sufficient for their wants. The Indians say that in old times there were but very few deer; latterly they became much more plentiful. About six years ago there was a very severe winter and a very heavy fall of snow. The Indians wantonly slaughtered many thousands of these animals, most of which were so poor as almost to be reduced to skin and bone, and for the most part unfit for food. The same winter many deer died from cold and starvation. As the deer are easily killed during a heavy fall of snow, the Indians are in the habit of praying for the latter as a great blessing. The following is a short account of the operations of the missionaries: They came among these Indians about nine years ago, and found them to be a poor, miserable, half-starved race, with an insufficiency of food and nearly naked, living upon fish, camas and other roots, and, at the last extremity, upon the pine-tree moss. They (the Indians) were in utter misery and want—*in want of everything*. Their whole time was occupied in providing for their bellies, which were rarely full. They were of a peaceable disposition, brave, good-tempered, and willing to work. Of spiritual things they were utterly ignorant. Unlike the Indians east of the mountains, they had no idea of a future state or of a Great Spirit; neither had they any idea of a soul. In fact, they had not words in their language to express such ideas. They considered themselves to be animals nearly allied to the beaver, but greater than the beaver—and why? Because, they said, "the beaver builds houses like us, and he is very cunning, too; but we can catch the beaver, and he cannot catch us—therefore we are greater than he." They thought when they died that was the last of them. While thus ignorant, it was not uncommon for them to bury the very old and very young alive, because, they said, "these cannot take care of themselves, and we cannot take care of them, and they had better die." The missionaries had an arduous labor before them. They commenced by gaining the good will of the inhabitants by means of small presents, and by the betrayal of great interest in their welfare in attendance upon the sick, and, as they prospered, by giving the poor creatures food, seeds, and instructions as to farming. The Indians could not help seeing that no hopes of temporal or personal benefit induced the missionaries thus to labor among them. The missionary told them that they had a Creator, and that he was good; he told them of their Saviour, and of the manner of addressing him by prayer. To this they listened and believed. The name they gave the Creator, in their own language, is "the One who made himself."

Of the soul they had no conception. In the beginning the priests were obliged to depend upon the imperfect translations of half-breed interpreters. The word "soul" was singularly translated to the Indians, by one of these telling them that they had a gut that never rotted, and that this was their living principle or soul. The chief of the tribe became converted, and was baptized Loyola; the mass of the tribe followed their leader. They now almost all pray, and have devotional exercises in their families, and seem in a fair way for further advancement. To show you the good sense, foresight, and benevolence of the priests, I will relate a short conversation I had with Father Hoecken, who is the Superior of the mission and has been among the people from the first. Says he: "Doctor, you will scarcely believe it; surrounded by water as we are, we often have difficulty in getting fish even for our Friday dinner." I replied, jokingly: "I suppose, father, that the *Indians* find no difficulty in observing a fast on Friday." He answered immediately: "I never spoke to them about it; it would not do. Poor creatures! they fast too much as it is, and it is not necessary for them to fast more." The people look up to the father and love him. They say that if the father should go away they would die. Before the advent of the missionaries, the inhabitants, although totally destitute of religious ideas, still believed that evil and bad luck emanated from a fabulous old woman or sorceress. They were great believers in charms or medicine. Every man had his peculiar medicine or charm, which was his deity, so to speak; and of it they expected good or ill. With some it would be the mouse; with others the deer, buffalo, elk, salmon, bear, &c.; and whichever it was, the savage would carry a portion of it constantly by him. The tail of a mouse, or the fur, hoof, claw, feather, fin, or scale of whatever it might be, became the amulet. When a young man grew up, he was not yet considered a man until he had discovered his medicine. His father would send him to the top of a high mountain in the neighborhood of the present mission. Here he was obliged to remain without food until he had dreamed of an animal; the first one so dreamed about becoming his medicine for life. Of course, anxiety, fatigue, cold, and fasting would render his sleep troubled and replete with dreams. In a short time he would have dreamed of what he wanted, and return to his home a man.

During the winter all the large game killed is brought to the camp and distributed equally among all. One man is chosen as distributor for the winter. To his lodge the animal is brought. He immediately cuts it up into a number of pieces corresponding to the number and size of the various families. As soon as it is all cut up, the chief cries, "Come and fetch." Immediately a delegate from each lodge appears and carries off the piece assigned him. Singular to say, no grumbling or dissatisfaction is ever manifested at the division. This custom was in vogue before the missionaries came among them; it was first established by their late chief, Loyola. He appears to have been a remarkable man, and a good chieftain and Christian. Although of a very quiet and taciturn disposition, he was a good disciplinarian and maintained his authority well. He was generally beloved, and had great influence over the tribe. Before his death, which occurred two years ago, he named the present chief (Victor) as the best man to be his successor. After his decease an election was held, at which all the members of the tribe voted, and by which Victor was almost unanimously elected. He is a small man, young, and of good countenance; but so good and amiable in his disposition, that he is scarcely able to maintain his authority over the tribe. One of his punishments is to whip the offender, but this he never does unless the culprit first consents to the infliction; after which, the latter will frequently laugh or run races, or play a game, or do something else in the way of fun to show how little he cares for the punishment.

At the mission they have a small mill, by which the Indians grind their wheat. The mill is turned by hand, and will grind but three bushels a day.

The missionaries say that these Indians are industrious and not lazy, as compared to other Indians; that they are willing to work, but that the land is so poor, and so little of it is susceptible of cultivation, that they cannot farm enough. The mission farm, as already stated, contains about one hundred and sixty acres. This is kept up for the natives, as but a few acres would be amply sufficient for the missionaries. Each Indian who wishes it is allowed a certain amount of land to cultivate for his own use, and is provided with tools and seed. The farm is for the most part on a terrace, raised some fifteen or twenty feet above the bottom of the river valley. The mould is rich and black, but very thin. Beneath this is a bed of bluish clay, very retentive of moisture and very barren. A small portion, (about two acres,) on the site of a former swamp now cleared and drained, is of deeper rich black muck, and yields excellent crops.

The land generally does not bear much cropping, and soon wears out. They cannot extend the farm higher on the mountain slope, on account of the poverty of the land and the abundance of springs. The large prairie of the valley-bottom, below this terrace, is about twenty feet above the present level of the river. This, although good rich land, is rendered unfit for agricultural purposes by the annual overflow, which subsides so late in the season as not to allow any ploughing or other work to be done upon it before the middle of July, too late for almost any crop.

The missionaries have long wanted the natives to move to the Cœur d'Alene valley, or to the Camas and Horse Plains, where the land is better. They have offered to transport the things necessary to build new houses, but the people are unwilling to go. They say: "This is our country; here are the graves of our forefathers; here we were born, and here we wish to die; we do not want to leave our country, poor as it is."

A few inches below the surface of the earth can be found the ashes and cineritious deposit of a volcano. The stratum is about one-third of an inch thick. As you proceed in a north-northeasterly direction, it becomes thicker and thicker. Hence we may infer that the crater was in that direction, and probably can now be found. The inhabitants have never seen it. They do not travel from curiosity, and the direction is among mountains from the very door of the mission. In the tribe there are men and women still living who remember the eruption. They say that it came on during the afternoon or night, during which it rained cinders and fire. The Indians supposed that the sun had burnt up, and that there was an end of all things. The next morning, when the sun arose, they were so delighted as to have a great dance and a feast.

In the neighborhood of the mission is a large grotto, said to be fifty feet square and very handsome. I was unable to visit it.

The Kalispelms are brave in battle, and are said to be feared and avoided by the Blackfeet. They are not quarrelsome, but are of good disposition. The missionaries have done great things for them—for their bodies as well as their souls. Theft is of rare occurrence. The people seem to be devoted to religion, so far as external forms go and to the extent that their present understanding will admit. It would take three hundred and fifty acres to supply them with sufficient food when the deer are destroyed. A little government aid could be well applied. Powder is dear with them, as also is everything else. Furs are scarce, and, in consequence, the people are very poor. While sojourning in these parts, I was told that there is an abundance of lead ore on the Kootenaie river. Black lead is found at St. Mary's, and gold on Hell Gate river. Copper and silver are said to exist in the mountains north. The loud, deep-sounding reports, like the explosions of heavy pieces of ordnance, occasionally heard in the Rocky mountains, and spoken of by Lewis and Clark in their narrative, are now and then heard. They never occur except during the coldest winters. The old trappers thought that these noises were produced by the bursting of silver mines. Their opinion in such a matter is of but little importance, to my mind. There are three or four explanations concerning the manner in which these sounds may have been produced. They may be simply volcanic detonations. These are frequently heard at great distances. Humboldt mentions having heard volcanic detonations in the Andes from Chillo, near Quito, a distance of eighty-eight miles. But the fact that these noises in the Rocky mountains are only heard during the *most severe winters*, seems to render this explanation improbable. Similar reports, attending the opening of cracks or chasms, are said to be common in the Polar regions. They may be caused by the detachment of heavy masses of ice, or more probably by land-slides. On the main Columbia, a short distance above Fort Colville, the black pipestone is found. There is no red pipestone west of the mountains, except that which is already fabricated into pipes. The natives have a few among them, which originally came from the Sioux country, and which they have obtained either as presents, by barter, or as war trophies. I left the mission on the 10th of November, and arrived at Fort Colville on the 13th. Here I was kindly entertained by Mr. Angus McDonald, the officer in charge of the post. Near the fort is the mission of St. Paul, established among the Kettle Fall Indians, on the left bank of the Columbia, about one mile from the Kettle Falls. I visited the mission establishment three times during my stay at Fort Colville. It is superintended by the Rev. Father Joset, assisted by one other priest and a lay brother. Father Joset received me very kindly. He is a Swiss, and very gentlemanly and agreeable in his manners. To him I am indebted for much valuable information concerning this part of the country. The mission establishment consists of a chapel, a dwelling-house, and several other buildings. There is no farm attached to it. The Indians have sufficient to eat, which they obtain from other sources. There is, consequently, no necessity requiring the missionaries to cultivate land, as they can obtain all they want for their own use from the Hudson's Bay Company. The Kettle Falls Indians call themselves Squeer-yer-pe. The chief of this tribe is called Pierre Jean. He, with most of his followers, live in their lodges around the mission. The number of souls in this band is about three hundred and fifty. During the summer season the Indians from all the surrounding country congregate at this place to catch salmon. There are then about one thousand at the falls. The Squeer-yer-pe name for the Kettle Falls is Schwan-ate-koo, or deep-sounding water. Here the Columbia pitches over a ledge of rocks, making a fall of about fifteen feet perpendicular. The Indians sow a little wheat and plant some potatoes, of which they are very fond; but their principal subsistence is the everlasting salmon. These come up annually in great numbers, on their way to the headwaters of the Columbia. The Indians, as before stated, all collect in the neighborhood of these and other falls, where they riot in feasting on their captured prey. They kill hundreds of thousands of these fish by spearing them. The myriads of salmon that ascend the rivers of the Pacific coast are almost incredible. In many places the water appears alive with them, and the shores are thickly lined with the dead and dying fish. This, according to De Smet, is particularly noticed on the small lakes of the upper Columbia, in the vicinity of Martin's rapids. The salmon ascend the Clark river to a point about twenty-five miles above its mouth. Here the great falls prevent their further ascent. The question has often occurred to me whether it would not be a good plan to blast out a raceway or gradual ascent over these falls, and thus allow a passage of the fish to the whole back country, from which arise the sources of the Clark. This certainly would be providing food for the Indians and others at a very trifling expense. The salmon of these waters, unlike those of other parts of the world, do not take the hook; and, strange as it seems, they are said never to stop searching after the source of the stream they are in. Their march is always ahead until they spawn and die; they never return to the sea. This seems to be the general opinion of the people with whom I have conversed.

The subject, however, will never be thoroughly understood until a number of careful, judicious experiments have been instituted. Salmon are taken on the hook by trolling in the salt water of

Puget sound. Herbert gives an account, taken from Richardson's Fauna Boreali Americana, of six different kinds of salmon known in the Oregon waters. The European fish are said to return to the sea after spawning; there they remain a year or two, until they become sufficiently restored, before they reascend the rivers to spawn again. The Columbia river salmon weigh from six to forty pounds; they are in excellent condition until they reach Wallah-Wallah, after which they are much poorer, both in flesh and flavor. The Indians along the river collect, during the summer and fall, these fish, which they want for winter use; these are split open and the bones taken out, leaving the skin with a layer of meat upon it, which when dry is about a third of an inch thick. These are scarified in various directions, and then hung for a short time in the smoke of a fire. They are then hung on poles or the branches of trees, where they are freely exposed to the wind. In a month they become perfectly dry, and are then housed in small store-houses, built much in the shape of the hay barracks of the eastern States, the floor upon which they are laid being, for security against dogs and wolves, raised about eight or ten feet above the ground boards; bark and matting are placed over them to secure them from rain, also from the depredations of the small fish crow (Corvus ossifragus.) Salmon thus dried forms the principal food of the natives during the winter. There is no venison, and scarcely any other game, in the vicinity of Fort Colville. The fur trade with the inhabitants in its immediate neighborhood amounts to but little. Almost all of the trade of this kind carried on by this trading-post is through the smaller forts it supplies in the Flathead and Kootenaie country, or among the tribes farther up the main Columbia. An Indian gave me a list of the various tribes and bands of Indians in the neighborhood of Fort Colville, and west of the Rocky mountains, who speak dialects and variations of the same language. These dialects are still so similar as to be easily understood by any of the Indians composing the bands.

Selish, (Flatheads,) T-com-oe-loops.
Spokane, (Spokanes,) Ne-com-ap-oe-lox.
Kalispelm, (Pend d'Oreilles,) Sar-lit-hu, near Okinakane.
Squeer-yer-pe, (Colville Indians,) Squaw-a-tosh.
Sin-poil-er-hu, (Sinpoils,) Sklarkum.

Wagon and railroad routes run through the Bitter Root and Cœur d'Alene mountains. The result of my observations, together with the information I obtained from the Rev. Fathers Hoecken and Joset, and from others, is as follows:

The valley of the St. Mary's river, from the junction of the Hell Gate and Bitter Root rivers to the Horse Plain, at the mouth of the Flathead or Pend d'Oreille river, will admit of a railroad line of easy grade; but the numerous very short curves obliging frequent crossings by strong bridges, the great length of the route if the river is followed, the steep banks and the high-raised work necessary to prevent the encroachments of the freshets, (which in many places rise from twenty to thirty feet above the common level,) will all render this part of the road exceedingly expensive. On the other hand, the character of the rocks is such that, where side and deep cuts are required, quarrying and blasting can be readily done. From the Horse Plain to the Cabinet there is a good, easy, natural grade on the right bank, with fewer curves and greater width of valley than above. There are, of course, a few obstacles, one of which is the "Fallen Mountain;" but the general aspect of this part of the route is good. At the Cabinet (a point about twenty miles above Lake Pend d'Oreille) the river is compressed between walls of solid rock about one hundred feet high. Its width here could readily be spanned by a single arch, and the road be made to take the left bank of the river. After reaching Lake Kalispelm, it could readily skirt the eastern and southern shore until it reached a southern prolongation of the lake, which extends about twenty-five miles in the direction of the Cœur d'Alene mission, and from that fact is called the Cœur d'Alene bay. From the upper end of this bay to the Cœur d'Alene lake there is a very gentle rise and a low divide, so low that it might readily be passed over by a traveller without notice. From the Cœur d'Alene lake to the valley of the Spokane river there is a good, natural, almost level grade. Just below the mouth of the Spokane river, on the main Columbia, there are a number of rock islands scattered across the river, affording great facilities for a bridge site in the solid supports thus furnished for piers and abutments. These rock islands, stretched across the river, are found at several points between Fort Colville and the Dalles. Loaded wagons have been driven from the former mission of St. Mary's to the Prune prairie, near the Horse Plain. They have also been driven from the Cœur d'Alene mission to the lower end of Lake Pend d'Oreille. Between these two points, a distance of about one hundred and sixty miles, wagons have not as yet passed. This part of the route, however, is feasible, and could readily be opened. In case this latter is done, a wagon route would then be opened from Fort Owen to Wallah-Wallah, from whence diverge other roads to the Willamette and Dalles, and one across the Cascade mountains to Puget sound.

I am, sir, respectfully, your obedient servant,

GEORGE SUCKLEY.

Governor ISAAC I. STEVENS,
In Charge of N. P. Railroad Exploration, &c.

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24. REPORT OF AN EXPLORATION FROM FORT BENTON TO THE FLATHEAD CAMP, BEYOND THE MUSCLE SHELL RIVER, AND THENCE BY THE SOUTHERN LITTLE BLACKFOOT RIVER TO THE ST. MARY'S VALLEY: BY LIEUTENANT JOHN MULLAN, U. S. A.

CANTONMENT STEVENS, BITTER ROOT VALLEY,
January 20, 1854.

SIR: I have the honor to report that, in conformity to your letter of instruction, dated at Fort Benton, September 8, 1853, directing me, with a "select party, to proceed to the camp of the Flathead Indians, then on the Muscle Shell river, one hundred and ten miles southeast of the Missouri, and there procuring the most intelligent and reliable Flathead guides, to make my way to the St. Mary's village, exploring the best pass to that point across the Rocky mountains from the headwaters of the Muscle Shell river," I left Fort Benton on the morning of the 9th of September, taking with me as a guide the "White Brave," a Blackfoot Indian, Mr. Rose, an employé of the American Fur Company, as interpreter, and Mr. Burr, to make a barometrical profile of the route travelled. In addition, there were three voyageurs and two Blackfeet Indians. My general course from Fort Benton to the Muscle Shell river lay in a direction south by east, by a very good road of four days' journey, passing between the High Wood and Judith mountains—two of the principal spurs of the Belt mountains—crossing several prairie streams that empty their waters into the Missouri.

In order to give a correct and detailed report of the general character of the route followed to the Muscle Shell river, thence westward across the Rocky mountains to the St. Mary's village, I have deemed it necessary and proper to make such extracts from my daily journal as will tend to point out routes, streams, prominent landmarks, and the characteristic features of the country passed over; noting particularly the quality of the soils, the forest trees, grasses, quality and quantity of water, and the practicability of the route for wagon trains; and such facts as my limited means allowed of to show the feasibility of the route for a railroad, as well as all others of general interest.

September 9, 1853.—All preparations having been made for our departure at the camp of the main train of the expedition, then on the Teton or Tansey river, we proceeded to Fort Benton, four miles distant, to procure certain Indian presents which we might need on the journey, and to take a farewell leave of the gentlemen of the American Fur Company, whose well-known hospitality had been extended towards us, and which none could more than ourselves appreciate. Our route, for the distance of five hundred yards, lay down the left bank of the Missouri, when, finding a ford with water from two to two and a half feet deep, we made the crossing in safety. The Missouri at this point flows with a rapid current over a rocky and pebbly bed, and is bounded on each side by a range of dark-colored hills or bluffs, about 100 feet high and destitute of timber, and which, on examination, proved to be composed of dark sand and clay commingled; our course being a few degrees east by south, and striking for the Belt or Girdle mountains, the base of which we reached at the distance of twenty-two miles from the Missouri. After journeying over this prairie for a distance of six or eight miles, we descended into the valley of a small stream called the Shonkee creek, which rises in the Belt mountains, and empties into the Missouri about one mile below Fort Benton. It is quite shallow, and very winding and tortuous. The valley of the stream is three hundred yards wide, which during the spring season is overflowed to the depth of thirty feet, and with a rapid current. The grass in this valley we found to be very rich and luxuriant. The stream itself is but slightly wooded, except at its head, where the pine is found in abundance, and growing to a large size. We crossed this creek five times during the day; fordable at each crossing. From the great number of dams observed, we saw that beaver in abundance are to be found in its waters. We continued up this stream—at times in its valley, at times along the bluff that bounded it—for a distance of twelve miles, when we reached what is called the Grand Coulée, running along the base of the northern slope of the Belt mountains. It is half a mile wide, and extends for many miles along the base of the mountains. We crossed this coulée and entered on a broad level prairie, which extends to the base of the mountains towards the east. Here we saw deer, which being very wild and shy, we were unable to secure one for our night's repast. Having travelled a distance of twenty-two miles, we encamped on a clear cold stream running from the Belt mountains, where we found good grass and an abundance of wood.

At night we took the precaution to picket our animals, over which a guard was placed until daybreak the next morning; for we were now on the great thoroughfare of the Blackfeet Indians, who, like so many bloodhounds, follow the tracks of the Flatheads on their roads to the hunt; and this being the highway between the Muscle Shell and Fort Benton, the nearest trading post, we felt the necessity of using every precaution in securing our animals from these treacherous and well-known horse-thieves. The night was clear, mild, and pleasant, but with a very heavy dew. We were not provided with a tent during our whole journey across the mountains, but we slept on this night as comfortably, rolled up in our blankets, as if we had been resting under some hospitable roof in more civilized climes.

September 10, 1853.—This day commences mild and pleasant; the thermometer, at sunrise, being 65° Fahrenheit. We resumed our march at 7.30 a. m., our course being in an easterly direction, striking for the Butte Canée of the Belt range of mountains, which lay on our course to the Muscle Shell river, through a valley which should have been named the Dog Town valley, for there were certainly more of the prairie dogs in this valley than I have ever seen in the prairie before, yelping and barking like so many bands of wolves. These prairie dogs make a most excellent dish, and constitute one of the luxuries of the country. Our journey continued through this valley until noon, for a distance of twelve or fifteen miles, when we halted on a fork of the Arrow river, which rises in the Butte Canée, a prominent landmark of the Belt mountains. A spur of the Belt mountains we continued to have to our right; it is a high and rugged range, having a general direction of east and west, and about 1,000 feet above the level of the valley. These mountains are covered with a growth of large pine, which is cut and used by the American Fur Company at Fort Benton, and is found to be exceedingly durable, the wood being found principally on the slopes and in the valleys of the mountains. I observed along the sides of this valley, or the bluffs that bound it, several beds of slate-colored rocks, at times of a form resembling basalt, and at times in horizontal layers from twelve to fifteen inches thick. Large masses of granite rock were also to be seen, covering, in places, areas of several acres square, which, being detached from the mountains by the frosts, were lying strewed in every direction at their base, many of them having a perfectly rectangular shape. We crossed, ten miles farther, a fork of the Arrow river, now dry, which takes its rise in the Belt mountains. This butte referred to rises to a height of about four hundred feet above the valley, and is perfectly flat or level on the top; at its edges are seen the outcropping of a dark gray columnar rock encrusted in many places with a white salt. The slopes of this butte have an inclination of seventy-five degrees, and are covered, as also at the base, with cedar and scrub-pine. The grass of this valley passed through, up to noon, we found dry, being buffalo grass; but around the margin of the lakes seen in the valley the grass is green, and exceedingly nutritious. The soil is of a light grayish color, as if baked in the sun, though covered with grass. There are to be seen along the northern side of this valley large beds of rock and salt, alternately. This salt, which I could not examine, but was told by Mr. Rose, is a species of Epsom salts, exceedingly purging in its nature, and at a distance would appear as so many large masses or beds of snow glistening in the sun. We found the valley much cut up with the holes of the badger, one of which the Indians killed. I would here mention that these Indians of the Blackfoot nation had before visited the vicinity of the Flathead camp, with the intention, if possible, to steal the horses of the Flatheads; but not succeeding, they placed themselves under our protection to visit this camp on friendly terms. This instance will show the duplicity to be found at times among the Indians, and especially among the Blackfoot nation. Finding they were unable to succeed as enemies, they were willing to try it as friends, and they knew they were perfectly safe in visiting the camp of their enemy under the protection of the whites. Besides, it is reckoned a coup for them to visit the camp of their enemies, a number of which visits makes a man a chief or brave, in the estimation of his people. Our guide, who was also a Blackfoot Indian, was acting under a promise. He had engaged to conduct us safely to the Flathead camp, to invite the principal men of their nation to accompany us across the Rocky mountains to the village of St. Mary's, and had engaged to conduct us across the Rocky mountains by one of the travelled trails, when he was promised to have a letter to the gentleman in charge of Fort Benton, stating that he had faithfully performed his duty, when he would receive his reward. Had he received it before he had performed his duty, I am convinced that he would have left me at the end of the first day.

Unfortunately, this morning I found that the barometer used by Mr. Burr had become unfit for service, which I sorely regretted, since I had anticipated having an excellent barometrical profile over a new and untravelled route. At noon we halted for one and a half hours, when we resumed our journey in the same direction until 4 p. m., when, one of the mules of Mr. Rose breaking down, we halted, after twenty-one miles' march, on the east bank of the main stream of the Arrow river, which we found to be a small and tortuous stream, that takes its rise in the rocky buttes of the Belt mountains, and empties into the Missouri twenty-five miles below Fort Benton. Its banks are well wooded, the cotton-wood tree being the most abundant; the scrub-cedar also occurring, though not abundantly. We found on this river good grass and wood; but the water was hard and brackish.

The river runs in a general direction nearly north through a very beautiful valley that crossed at right angles the valley through which we had been journeying all day. The valley is lined on each side by high clay bluffs, with occasional out-croppings of a dark-colored rock. Game was exceedingly scarce; prairie dogs being the only living thing seen, save occasionally a wolf or an antelope, which latter would be frightened from their beds at least a mile in advance of us, and soon would be seen bounding off to the mountains that limited our view to the right of the valley. Grass we found to be dry, though highly relished by the animals; the only water seen was the fork of Arrow river that takes its rise in the Square Butte of the Belt mountains, and a small brook, about two feet wide, that takes its rise from a spring in the bluffs of the valley. We had the fork of Arrow river referred to to our right until we struck the main stream. During this night we were visited by an exceedingly heavy rain, accompanied by much thunder and lightning, which was concentrated in the western portion of the horizon. It rained from 9 to near

11 p. m., when it cleared off and became beautifully starlight till near 1 a. m., when it showered heavily until near morning, giving some of us a wet bed for the night. This, however, was not much heeded, for, being tired and wearied, we slept as soundly as if on downy couches. I would here mention, what I have often noticed before in this region, that the season for rain seems to be the night—a thing somewhat remarkable. There have been but few exceptions to this, that I have noticed. This for the traveller is fortunate, for, above all things, travelling in the rain is anything but comfortable, though the comfort of sleeping in it might be questioned by some. What is the cause of this singular periodical occurrence of the rain, has been asked by many who have noticed it. The mornings and evenings are exceedingly cold; the days quite warm. The mornings at this season are in every respect similar to the mornings of the month of May in the States of Maryland and Virginia, and the section in the vicinity. Though the country presents rather an uninviting appearance, the grass is dry and yellow, and, being entirely prairie, it looks dreary, and at times exceedingly sombre. I have supposed this somewhat singular phenomenon to arise from the great difference of temperature of the day and night; the air, which during the day is rarefied by the heat, at night becomes suddenly condensed and returns to the earth in the form of rain.

September 11, 1853.—This day commences mild and pleasant; the rain during the last night warmed the atmosphere very much, which rendered this similar to a summer's morning, the thermometer at sunrise being at 60° Farenheit. We resumed our march at fifteen minutes to 7 a. m., which lay for the distance of a mile along the Arrow river; thence east, when we entered the "Mauvaises Terres," a portion of the same that we found lower down on the Missouri. These lands we found to be about two miles wide, and extending along the Arrow river to the Missouri. They were more rough and rugged than any I had seen in the prairie country bordering the Missouri, up which I had travelled a distance of twenty-one hundred miles. They are totally destitute of timber, and present a black, barren appearance, being composed of a mixture of sand and clay, the clay predominating; the whole being highly impregnated with iron. In some places the ravines through these lands were perfectly awful to behold, descending to the depth of many hundreds of feet. After having ascended to the top of a high bluff we would be compelled to descend a slope sometimes of sixty degrees, and ascend another nearly as high, when the distance between the summit would be but a few yards. Fortunately for us, these lands extended but a short distance, but even this was very trying to our animals. Our course after leaving these bad lands lay over a most beautiful and level prairie, which extended for many miles in length and ten or twelve miles in width, with an occasional hill and valley. The grass on this prairie we found to be exceedingly high, though dry. Arriving at the end of this prairie we came in sight of the Judith mountains, a high range of mountains running both west and southeast; these mountains lay about eight miles distant, and to our left, while the main chain of the Belt mountains lay to our right, and about thirty miles distant, having a general direction of north and south. Water along the whole route was exceedingly scarce, and what we found was very brackish. Wood we found none since leaving the Arrow river. No game was to be seen save three buffalo bulls, one of which the Indians with us succeeded in killing; they saw him for a distance of five miles before securing him, and when secured he turned out to be so poor and lean as to be unfit to eat, save his haunch and tongue, which they brought to us. Our journey lay a little to the south of east during the whole of the day till we struck a tributary of the Judith river, which tributary takes its rise in the main chain of the Belt mountains; the fork or tributary we found to contain but little water, which lay in pools, and was very unpalatable. We journeyed on for six miles farther, camping on a second tributary of the Judith river that rises in the same chain of mountains. The main stream of Judith river takes its rise in the Belt mountains, and empties into the Missouri near three thousand miles above its mouth. About noon of this day we observed it raining heavily in the Belt mountains, while it was clear and beautiful in the prairie over which we were journeying. Our march on this day was about twenty-two miles to the second fork of the Judith river, which was somewhat similar to the first above mentioned; it contained but little water, and that brackish. The grass here we found to be good, but no wood was to be seen for miles around; there were a few willows growing in places on the banks of the fork, which, in addition to furnishing us fuel for cooking, were made use of by the Indians for building a shelter from the dew and rain. The ends of the longer ones they would sharpen and stick into the ground, bending them in the form of a semicircle. These willow houses, the remains of which are often seen in the prairies, afford a very comfortable lodging, and withstand the effect of the heaviest rains or winds. The valley of the tributary of the Judith river on which we encamped is about five hundred yards wide, the river being exceedingly tortuous. The grass in the valley, which was the buffalo grass, we found to be very abundant, and it proved for our animals to be exceedingly nutritious. Up to 12 p. m. was beautiful, with a pleasant moonlight, when it commenced raining and continued for two hours in torrents, which gave each of us a wet and uncomfortable bed for the remainder of the night; at 2 a. m. it cleared off and became a beautiful starlight morning. The wolves, as usual, gave us their nightly serenade.

September 12, 1853.—Monday commences mild and pleasant, the thermometer 47° Fah. We resumed our journey at twenty minutes to 7 a. m.; our course being in a direction south of east, over a very beautiful and level prairie road. The grass on the prairie, and even in the valley, we found very dry; water, as yesterday, being exceedingly scarce until we struck the main branch of Judith river, which, taking its rise in the main chain of the Belt mountains, we found to be a stream of most beautifully clear, cold water, with a rapid current, the water being from eighteen inches to two feet deep; its banks also, as far as I could observe in either direction, were of a gravelly formation. This stream winds through a very beautiful but narrow valley, which, during high water, is the bed of the stream. The eastern portion of the Belt mountains being called the Judith mountains, might lead one to suppose that the Judith river takes its rise in the Judith mountains, but such is not the case. On our road the so-called Judith mountains lay to our left, while the main chain of the Girdle or Belt mountains lay to our right. The low ranges might with propriety have no separate and distinct names, as they are separated by a gap or pass fifteen or sixteen miles wide; but when taken together they form a belt or girdle, the concavity of which is turned towards the north. The name has been applied to them of the Girdle or Belt mountains. Five or six miles farther we struck another tributary of the Judith river, coming from the west with a rapid current, being from fifteen to twenty feet wide; water clear and cool, and very excellent. The grass on this stream we found to be good, its banks being totally unwooded. I saw in the distance still another tributary coming from the so-called Judith mountains, on the banks of which were scattered a few pines and cotton-woods. The grass on the Judith river where we made the crossing was not good; its banks are unwooded, both where we crossed it and as far up and down as we could see. The Judith mountains, as also the approaches to them, are well wooded—the pine tree abounding. At 12 m. we halted on the main tributary to the Judith mountains, where we remained an hour and a half, having travelled a distance of seventeen miles from our camp of last night. Just before reaching this tributary, we saw to our front, and at a distance of five or six miles, a large band of buffalo coming towards us, which caused us to think we were approaching the Flathead camp. Game we found to be more abundant than on any day since leaving the Missouri. We succeeded in securing four buffalo, which were killed by the Indians with us. Elk in large bands, and many ducks, were seen during the day. Resuming our journey along the last mentioned tributary of the Judith river, our course lay over a beautiful and level prairie, the grass of which was abundant and excellent. Still continuing to have the main chain of the Belt mountains to our right, and the Judith mountains to our left, at half-past 4 p. m. we came in sight of the Snow mountains, a range south of the Muscle Shell, which at a distance appears higher than either the Belt or the Judith mountains, and whose snow-capped peaks now towered high above the surrounding country. At the same time, we struck a small stream with an exceedingly rapid current, taking its rise in the Judith mountains, which we called Buffalo creek, from the great numbers of buffalo seen on its banks. This stream was unwooded, its water being clear, cool, and limpid, in which were to be seen great numbers of mountain trout, some of which our Indians succeeded in catching. The grass along its borders was excellent and green. Our camp of this night was at the foot of the largest peak of the main chain of the Judith mountains. About 8 p. m. we were startled by the approach from the mountains of a large grizzly bear, that came running with full speed into our camp. The horses were frightened, and were preparing for a stampede, when their picket-ropes held them fast. Mr. Rose, who was on watch at the time, and our Indians, had secured their guns; but seeing them, he turned to the right, and soon was seen scampering away across the prairie. The night was exceedingly mild and beautiful, the moon shining clear and bright till after 12 p. m. Our camp was a scene of feasting and good cheer, having killed an abundance of buffalo during the day; the meat at night was served up boiled, baked, roasted, and fried. This was a grand season for the Indians; they sat up half the night aroung the camp-fires, cooking—our fuel consisting of the wood left by a Blackfoot camp. The Judith mountains are a great resort for the Blackfeet Indians during the summer season, as game of all kinds is found in abundance; and here, too, they procure poles for their travels and lodges, and everywhere were to be seen their old camping-grounds, one of which was chosen by our guide for our night's camp, as there was here found an abundance of wood.

Having then plenty of wood and an abundance of meat, the Indians had no difficulty in serving up for themselves a rich repast; and around the high blazing fires were to be seen roasting the fat tender-loin ribs, and all the choice pieces of the buffalo, in addition to the many ducks killed during the day. They rested content and perfectly happy.

September 13, 1853.—Commences mild and pleasant, the thermometer at sunrise being 53° Fahrenheit. On rising this morning we found our camp surrounded by buffalo, so numerous were they in this vicinity. Between the main chains of the Girdle and Judith mountains, and near the gap between them, is a large and beautiful prairie, well grassed, with numerous streams flowing through it, where the buffalo congregate in vast numbers; so that the traveller may be well assured to find an abundance of game, both of the buffalo and antelope, as large bands of the latter were to-day seen along the margin of the western tributary of the Judith river, which are so tame and gentle as to allow the hunter to approach them within a very few yards, so unconscious of danger are they, and which, when frightened, run off a few yards, stop, and look their pursuers in the face with the greatest curiosity. They are often killed by the hunter, who, after following them for some time, crouches himself in the grass, when they will turn back to see what has happened, when, on reaching within killing distance, they often become victims to the unerring rifle.

Our course lay this morning, till near noon, a few degrees east of south: first, over a partially broken country, and then over a most beautiful and large prairie that extends from the Muscle Shell river to within thirty miles of a spur of the Girdle mountains, covered with very fine grass. We had this morning a very fine view of the Snow mountains, which rear their lofty snow-covered summits far above the country for miles around. Game we found on this day exceedingly abundant—the hills and prairies, as far as the eye could reach, being perfectly alive and black with buffalo: not less than from ten to twenty thousand might be seen in bands running over the prairies. One of our Indians ran into a large band, and, having selected one of the fattest, he singled him out from the rest and brought him down immediately on our pathway. We were not in want of game this day, as we killed, during the morning, two large buck antelopes, the meat of which we found exceedingly fine: this, with the buffalo, made us an abundant supper at night.

We nooned this day at the source of a small stream that empties into the Muscle Shell river, after having made a journey of twelve miles. During the afternoon our journey lay over the prairie already mentioned, to the Muscle Shell river, which we reached at 5 p. m., making five days from Fort Benton, where we struck the river. I estimated it to be one hundred and thirty miles from the fort. This river is a wide and deep stream, that rises in the Belt mountains, which here form the most eastern range of the Rocky mountains, and empties into the Missouri just below the mouth of the Judith river. It winds through a most beautiful valley of ten miles in width, the grass of which we found very high, excellent, and green. This river is about forty to fifty yards wide, and between two and four feet deep, with a very rapid current; the current is much more so where we struck it than that of the Missouri itself. The stream during the high-water season, judging from the portion of the bed at present dry, is about one hundred and twenty yards wide; the water is perfectly clear and limpid. This stream is exceedingly well wooded, the trees growing in the greatest abundance on its banks being cotton-wood, willow, and wild cherry. Where we struck the river, which was below its two forks about one mile, the bed of the stream has a gravelly bottom. Large quantities of gravel are also to be found on its banks, forming in some places a purely gravel formation. About five miles before striking the Muscle Shell we found a large bed of gray sandstone that outcropped from the bluffs or hills of the prairie, which was highly impregnated with iron. This has been the only rock that has been observed since leaving the Highwood mountains.

The night of this day was mild and pleasant; very little frost during the night, but towards morning it became very cold.

September 14, 1853.—Commences very cold and cloudy. At half past 4 a. m. the thermometer stood at 38° Fah., the appearance of the clouds in the west giving indications of rain. The air from the Snow mountains this morning we found exceedingly chilly, making an overcoat quite comfortable. We resumed our march at 6.30 a. m. During the evening of the previous day we examined to see if the Flathead camp had passed the Muscle Shell below the point where we struck it. Our guide examined on both sides of the river, and finding no trail on either side, we concluded that their camp must be still up the river. We had heard they were on the river, above the forks; so we turned our horses' heads up the river in search of their camp, which course we pursued for four miles, when we found unmistakable evidence that they had gone down the river. Retracing our steps, we followed the river along the left bank for nineteen miles, to our noon halt. After journeying six miles below our camp of last night, we fell upon a camping ground of the Flatheads, which we supposed they had left about three days before. About the same distance farther down we fell upon a second camp they had left, where we had nooned.

The valley of the Muscle Shell river still continues to be well grassed and well wooded, the cotton-wood still abounding; the stream retaining its general width. When journeying down the river, we passed the mouth of the fork from the southwest that rises in the snow mountains. The northwestern fork takes its rise in the main chain of the Belt mountains. The southern fork is well wooded, by which means you can trace it far along in the distance, as it rounds through the valley to the base of the mountains.

At our nooning of the day, there was to our left, rising from the bluffs of the valley of the river, a high and wooded ridge, extending to the Highwood mountains, the wood being principally of pine.

Having found that the trail of the Flatheads crossed the Muscle Shell, we passed to the opposite bank, when we entered a very rough and rugged country, crossing a short prairie in the interval. About two or three miles after leaving the Muscle Shell we passed a high ridge of rocks, covered with pine. This ridge was about three hundred feet high above the valley. This was only the commencement of the bad lands that extended back from the river for a distance of many miles. Ascending a high peak in following the trail, we could see far into the distance, but no sign whatever of the Flatheads met our view. The appearance of the trail indicated that it was at least six days old. I here concluded that with my pack-animals it would be impossible for us to overtake them at our present rate of travelling, so we went into camp, which I placed in charge of Mr. Burr, and early the next morning started with the Piegan guide, mounted on two of our best horses, in search of their camp. This we followed for a distance of about eighty miles southeast of the Muscle Shell, when we found them encamped in a very beautiful valley, formed by the rocky bluffs of a deep ravine.

The first few miles of the journey lay over a very rough and rugged country, that led through a deep, wide valley, which was bounded on each side by high, steep, rocky hills. This rock was hard sandstone, the strata of which were horizontal. This formation I could trace by its exposure for many miles, which extended back into the prairie. About fifty miles from the Muscle Shell the country changes into a large and beautiful prairie, which is dotted by many large and beautiful lakes, in which we found the greatest abundance of ducks and geese. Much game of every kind was to be found through this portion of the country. No streams were to be seen—in fact no water, save that of the lakes, and the very many coulées to be found through the whole section of the country. About 7 o'clock of this day we neared the Indian camp. Their horses I could see at the distance of many miles, being so very numerous. I took them to be a large band of buffalo; but by a nearer approach, and with the aid of my glass, I soon saw they were horses. When the guide and myself had reached their camp, three or four men met us at the entrance, and invited us to enter the lodge of the chief. They very kindly took care of our horses, unsaddling and watering them. As soon as the camp had heard of the arrival of a white man among them, the principal men of the tribe congregated in the lodge of the chief. When they had all assembled, by a signal from their chief they offered up a prayer. This astonished me; it was something for which I had not been prepared. Every one was upon his knees, and in the most solemn and reverential manner offered up a prayer to God. For a moment I asked myself, was I among Indians? Was I among those termed by every one savages? I could scarcely realize it. To think that these men should be thus imbued, and so deeply too, with the principles of religion, was to me overwhelming.

After the prayer, I asked if there was any one in the camp who could speak English. This question to them was like Hebrew; they understood me not. I then asked, in French, if there was any one who could speak French. At this, one spoke up that he could. Imagine my feelings of joy at this. It fully and amply repaid me for the many and frequent annoyances that I had met with in studying the language, for I had started without an interpreter, trusting to fortune to find some one who could understand me. I requested him to act as my interpreter for the remainder of his tribe. He was a full-blooded Flathead, and he told me he had learned to speak French on the prairie, among the French Canadians and the French half-breeds. I explained to him in detail the object of my visit to their camp; that I had come among them having a message from their father, which came from the Great Father, who requested them to send their principal chiefs and braves to meet their agent west of the Rocky mountains, and that I desired them to accompany me to the St. Mary's village, west of the mountains; that my sole purpose among them was for the good and welfare of their tribe, and I explained to them the benefit and necessity of some of them going with me. The chief told me that he would let me know in the morning what he thought of it, and had in the meanwhile prepared for me a supper of boiled buffalo-tongues, and a bed of buffalo-robes, upon which I slept soundly till morning, when I was aroused by the same men, who had assembled before I had arisen, singing and praying. The interpreter being present with the remainder, I asked him what the chief thought of my proposition that some of the chiefs should accompany me. He said he was opposed to it; but that *he*, with all his lodges, would move off to see the Governor, killing game on the road. He said that they had crossed the mountains to kill meat for the winter for themselves and family, and that they could not think of going singly. I explained to him the impossibility of his seeing the Governor at all by travelling with all his lodges, for he would necessarily be compelled to travel slowly, and that I desired to travel quickly in order to arrive west of the mountains in good season. I told him it was not absolutely necessary for him to go, but that he could send some of his principal men. Finally, after much persuasion, this he consented to do, and said he would give me five, who were accordingly ordered to accompany me; one, however, of the number, not placing so much reliance in what I had told them as the remainder, turned back, and the remainder of them followed me to my camp. When we arrived next day, having travelled about one hundred and fifty miles in the search for them, I remarked the great affection displayed in their parting; they bid their families and friends a most affectionate farewell—something that is not always to be seen amongst Indians. They had with them one hundred and twenty lodges, being Flatheads and Pend d'Oreilles; only fifty lodges, however, being Flatheads. There were seven lodges, with Victor, their principal chief, on their way to St. Mary's village. The Flatheads are a fine-looking, noble race of Indians; they have conformed more to the customs of the whites than any Indians west of the mountains. But they show the Indian still; they are profuse in the use of paint, and are great lovers of beads, and are fond of trinkets, gewgaws, and ornaments of every kind. The women are kept in the same wretched state of drudgery as the women of all other tribes of Indians; they pack and unpack the horses, pitch and strike the lodges, cook, carry wood, water, and, in fact, do everything there but hunt. Their young men are fine-looking and athletic, and exceedingly intelligent. I asked them if they had any troubles to complain of, and, save with the Blackfeet, they said no. They say that were it not for this bad nation they could live happy and contented; but these, their enemies, make incursions into their country, carry off their horses, kill off their men, and all this without provocation. They represent that with the whites they are always at peace, and are always glad to see or meet with them, and look upon it as a bright spot in their history that they have never as yet shed white man's blood, and they could not see why their interests by the whites were so much neglected. They said they desired to have a general peace with all the Indians, both east and west of the mountains, and that they expected much, very much good, through the interposition of their agent; they spoke very sagely and very affectingly, and felt all they said. They have little or no gesture in speaking, but, as among all Indians, express themselves to a great extent in signs. Four of the five came with me, but the other, thinking it was all a hoax, started back; but the four, arriving at my camp, partook of an excellent supper, and after their usual smoke were perfectly contented and happy, and appeared much more willing to accompany me than to return to their camp.

September 18, 1853.—Commences very cold and windy, the thermometer being 38°. The Snow mountains, which lay in full view this morning, are covered to near their bases with snow; the wind, blowing immediately from them, is cold and chilly. Having remained in camp three days and four nights, our animals recruited very much, and were well prepared to withstand a long day's march. Resuming our journey this morning, I noticed that our guide showed an evident disposition of unwillingness to accompany me farther. Through the interpreter he had asked me to release him from his engagement, and to allow him to return to his home. This I refused to do. I told him that he had engaged with Governor Stevens to conduct us to the Flathead camp, thence to the village of St. Mary's, west of the Rocky mountains, and that he must fulfil his engagement before leaving. He appeared very sullen, and promised to accompany us to the end of our journey. When everything was ready, I told him to mount his horse and come on; he said he wished to smoke, and that he would overtake us in a short time. Presuming that he had fully made up his mind to accompany us, I thought nothing of it, but rode on without him; we have not seen him since. I only regretted that he had not received a cudgelling before leaving. Our Flathead guides, however, proved this day invaluable, and gave promise to conduct us quickly and safely across the mountains. Our journey lay up the valley of the right bank of the Muscle Shell river. We struck one of its forks coming in from the south, upon which we nooned eight miles above its junction with the main stream. This fork, or tributary, flows through a beautiful and well-grassed valley of two and a half miles in width. The stream, with a rapid current, is at present only ten yards wide, with a gravelly bottom, well wooded to its source in the Snow mountains, the cotton-wood occurring in great abundance. Extending for a long distance on the right bank of this fork is a bed of lignite, of twenty-five feet in thickness. From this fork our trail led over a very excellent road for twelve miles, till we struck the main stream of the Muscle Shell, crossing in the mean while several prairie streamlets that empty their waters into the Muscle Shell. Travelling up the river four miles farther, we encamped on its right bank, finding an abundance of grass, wood, and water. Game, to-day, was very abundant. Buffalo in large bands, antelope, elk, geese, and ducks were seen during the day. The night of the day was mild and beautiful till towards daybreak, when it became cool and chilly from the Snow mountains.

September 19, 1853.—Commences clear and cool; the thermometer at sunrise 24½°. We resumed our journey at 6 a. m., following up the valley of the northwest fork of the Muscle Shell, which on this day we found much less wooded than that already travelled, still continuing, however, well grassed. The Belt mountains to-day approach quite close to the banks of the Muscle Shell on the north. We saw plainly to-day that the Snow mountains are not a separate and distinct range, but form a part of the Girdle or Belt mountains, and are called the Snow mountains when the range crosses the Muscle Shell, where they increase in elevation to such an extent that many of the higher peaks are always covered with snow; hence the name that has been applied to them of the Snow mountains. The range of the Belt mountains running along the Muscle Shell, taken in connexion with the spur along the Missouri opposite Fort Benton, and the range running from the Missouri to the Muscle Shell, form the two parallel sides, and diagonal of a parallelogram, the diagonal having a general direction of northwest and southeast. The country south of the Muscle Shell, extending to the base of the Snow mountains, is very rugged and broken, while that to the north, towards the Belt mountains, is partially wooded, and rises gradually from the Muscle Shell river to the base of the mountains. We passed this morning the mouth of the southwest fork, coming from the Snow mountains, which was well wooded, and as large and rapid as the northwest fork, with which it made an angle of 38°. By following along this southwestern fork you strike the Missouri at or near the gate of the mountains, and cross the main chain of the Rocky mountains by following up the Jefferson fork of the Missouri. On the left bank of the river we noticed this morning a rock formation, occurring in thin layers, similar to that about sixty miles south of the Muscle Shell. As a general thing, the banks of the Muscle Shell and those of its tributaries are of a clay formation mingled with much gravel, the bed of the stream being also gravelly and rocky. Having travelled a distance of twenty miles, we nooned on the right bank of the river, where we found excellent grass, but no wood; which latter seems to be more scarce the farther we travel up the river. At 2 p. m. we resumed our march, continuing along the right bank of the river, over a very level and beautiful prairie that extended to the base of the Girdle mountains, which at this point cross the main stream or northwest fork of the Muscle Shell, and run towards the south for three or four miles, crossing the southwest fork, where, bending more to the east, making an angle of 30° with the main river, they become the Snow mountains. After travelling six miles farther, our trail lay through a pass in the Belt mountains, formed by the valley of the Muscle Shell river, which we followed to our night's camp, crossing the river at its head branches, several of which are unwooded, the grass of the valley being excellent. The mountains on each side of the valley of the northwest fork are about 1,000 feet high, well clad with the yellow and spruce pine, growing to a height of seventy-five feet, perfectly straight, and from twelve to twenty-four inches in diameter near the ground. The mountains are formed of a cream-colored, unstratified rock, exposures of which would be seen at times along the slopes. The willow, in great abundance, is found on the banks of the head branches of the stream growing to a height of six and eight feet. We camped to-night on the left bank of the stream, having marched thirty-five miles.

September 20, 1853.—Commences cool and clear, the thermometer at sunrise being 24°; frost last night was exceedingly heavy, covering the ground like a coating of snow. Our camp of last night being in the valley of one of the head branches of the Muscle Shell, with high mountains on each side, it is possible that we had frost much heavier than if we had been on the plains. We resumed our march this morning at 7 a. m., our trail being over a very excellent road along the left bank of the head branch of the Muscle Shell, on which we encamped, for about two miles, where, leaving it to our right, our course lay to the west over a prairie road at the base of the slope of the range of mountains to our left. After passing over this well-grassed prairie road, which formed the divide of the valley, we fell upon the headwaters of a stream flowing towards the west and emptying into the Missouri, which, from its general character, valley, bed, and direction, we took to be the Smith's river of Lewis and Clark; it is called by the Indians ———. It rises in the western slope of the mountains, receiving tributaries, small but rapid, from many points in the mountains on the north and south. The hills here, and along our whole journey, continued to be covered with the cedar, bush-willow, and spruce-pine, which grows small, but exceedingly abundant. To-day hills and mountains assumed a more rugged appearance than we had noticed on any day previous; high rocky bluffs at times outcropping from the hills, of a dark black or brown color, commingled with a light cream-colored rock apparently of a hard texture. The hills on each side of the valley were from five to six hundred feet high. The brooks, streams, and rivulets passed and crossed to-day were very numerous. The grass along our whole route was exceedingly fine and luxuriant in the valley; along the slopes of the mountains, however, which were covered with rocks and pebbles, the grass was very spare and dry, contrasting well with the beautiful green meadows of the valley below. Game to-day was very scarce, only one elk and four antelope being seen during the day: the latter being exceedingly shy, precluded all possibility of approach; the former we succeeded in killing, but he proved unfortunately to be a six-year old buck, poor and good for nothing, which we sorely regretted, as we were now without meat. We nooned to-day on Smith's river, where we found good water, grass, and wood; the latter, however, was not abundant, the stream here having a width of forty feet. We continued down the valley of this river during the remainder of the day, which was from a mile to a mile and a half wide, and perfectly level. It is probably one of the prettiest valleys to be found in the mountains. For miles you see before you a level prairie bottom, bounded on each side by the gently sloping hills of the Belt mountains, which are covered with a thick and even growth of the pine, and through the middle of this prairie the Smith's river, with its banks bordered by the willow, birch, and cotton-wood, flows. The water of this stream is clear and cool, its bed pebbly, and current rapid. The weather to-day has been very warm, rendering a coat uncomfortable, contrasting greatly and agreeably with the weather of the two days previous. Some of the higher peaks of the mountains on the south side of the valley were covered with snow, while none was to be seen on the mountains towards the north. After a long day's march we camped on the left bank of Smith's river, where we found good wood, grass, and water. We had a luxury to-night in a string of mountain trout, brought into camp by one of our Flathead friends; these trout, which form a very excellent dish, were twelve inches long, of slightly yellow tinged color, and spotted on the upper half, and look not unlike the common mackerel of the East. Our Indians displayed on this occasion a trait worthy of notice. They were without meat, or anything to eat. We were without meat, but had a little flour left from our small stock of provisions. These being the first fish caught by any of the party, they insisted on our taking them, which we refused; but still insisting, we were compelled to accept them. This is certainly an example of boundless generosity. I cannot say too much in favor of these noble men who were with us; they were pious, aged, firm, upright, and reliable men; in addition thereto, they entertained a religious belief which they never violated. They partook not of a meal without asking a blessing of God; they never rose in the morning or retired at night without offering a prayer to God. They all knew the country well, and made excellent guides and good hunters; and when they could not find fresh meat they accepted of the remnants from our scanty table with the greatest humility and contentedness, contrasting well with our Blackfeet friends, who had just left us, who made free with anything belonging to us, and who looked upon our table as their own. These Flatheads have always been, as an Indian tribe, held in the highest estimation, and this I can fully confirm from actual observation. When one or two went out in the morning to hunt, they gave full details as to water, grass, wood, halts, meeting each other, &c., so fully did they appreciate their position. The night of this day was exceedingly mild and pleasant; the frost, however, being very heavy, which before morning coated the ground as with snow.

September 21, 1853.—Commences clear and cool, the thermometer at sunrise being 26°. We resumed our march, continuing down the valley of Smith's river for a distance of two miles, when, turning more to the south, we left the river far to our right; and when ascending a prairie hill, near two hundred and fifty feet high, we could trace its windings though the valley of the hills for a distance of many miles, still continuing to flow through a beautiful and charming valley, receiving tributaries from the mountain slopes on each side. Our course lay till near noon over a series of undulating prairie hills, having to our left, about three miles distant, a large tributary of Smith's river, well wooded, and to the south of it a high range of well timbered mountains, some of the summits of which are covered with snow. The mountains to our right continue to be very high and well wooded. Near the summit the prairie hills over which we passed this morning are covered with rock, stones, and pebbles in every direction, which made travelling difficult for our animals. Game in the valley of these hills we found very abundant, being principally antelope, but so exceedingly shy as to prevent all possibility of approach. About 11 a. m. we entered the valley of a small stream turning towards the east, upon which we nooned, finding here good wood and water, but very poor grass. This valley was one hundred yards wide, the hills or mountains on each side being about five hundred feet high, and clad with the pine, growing to a height of sixty feet and perfectly straight. At our noon halt, two of our Indians who had left us early in the morning returned with seven large mountain trout which they had caught in Smith's river; these were similar to those of the night previous, but of much larger size. Our course during the afternoon lay to the south, up a steep mountain five hundred feet high, which we were compelled to ascend to gain a ridge which we could follow, as the valley was so obstructed by rocks and brushwood, and so very narrow, that it was perfectly impossible to follow it to its head. When gaining the top of this mountain, nothing was to be seen save an immense bed of rugged mountains. From the summit of this mountain our course lay more to the west, over a very excellent road, leading through a thicket for a distance of two miles, the timber being the pine, hemlock, cedar, and spruce. After passing the thicket referred to, we came in sight, for the first time, of the main chain of the Rocky mountains, the object of all our hopes and ambition. These mountains we supposed to be at a distance of near fifty miles, and reared their lofty heads far into the blue sky in the distance. Our only regret on seeing them was, that we were not on the west side of them. We had now gained the divide or highest ridge of the mountain, and now commenced a descent, dangerous both for our animals and ourselves. The mountains which we had to descend in order to reach a valley conducting us to a valley of the Missouri, was one thousand feet high, with a slope of 65°. This was formed of dark-blue slate, which in most places was exposed, presenting its rough edges to our horses' feet, making the travelling very bad and dangerous. We were compelled to dismount; and wearing nothing but moccasins, it was exceedingly trying to our feet. This slate formation dipped towards the west at an angle of 45°, the largest strata being from an eighth to half an inch in thickness. Gaining the base of the mountain, we entered a narrow valley or ravine, through which flowed a brook or mountain stream, the waters of which ran to the west and emptied into the Missouri. This valley or ravine was about seventy-five yards wide, which we followed down for several miles, camping about six miles from the base of the mountain. Here we found the mountains on each side to be composed of a red slate formation. The mountains on each side of the gorge have been heavily timbered with the pine, but a fire has lately passed over them, destroying nearly every tree. Game we still continued to fine very scarce; one of our Indians, however, succeeded in killing an antelope, which added very materially to our comfort. The night of this day was exceedingly pleasant.

September 22, 1853.—Commences very mild and warm. We resumed our march at 6 a. m., continuing down the ravine of the mountains, in which we have encamped for a distance of three miles; the geological formation of the ravine or mountains on each side being first a blue, which lower down changes into red slate, and finally into a greenish gray slate, till, reaching the end of the ravine or cañon, the slate character becomes completely lost, and changes into a rugged, rough, weather-beaten, cream-colored rock. Where the small portions of rock have been broken off and fallen into the ravine, it made the travelling very bad for our animals. At the end of this cañon we came in view of the valley of the Missouri, which was eight miles wide, and a most beautiful, well-grassed prairie bottom, this extending on each side of our route as far as the eye could reach. Far to our left lay a high ridge of the Rocky range, and in the rear of it a snow-clad range, which in the bright sunshine glistened like a mountain of silver. Far to our right lay another rough and rugged ridge of the Rocky range, while to our front lay a third, bounding the left bank of the Missouri. Crossing this prairie by a very excellent road, we fell upon the main stream of the Missouri, which we found to be a rapid, clear, and tortuous stream, near two hundred yards wide, the channel water being six and eight feet deep. The river being shut in by the mountains on the west and hills on the east, becomes in places exceedingly rapid; its banks are wooded in places with the cotton-wood; the willow, however, occurs very abundantly along its banks, on both sides. Not being able to find a ford when striking the river, our course tended down it for a distance of six or eight miles, when we nooned on the right bank of the Missouri, finding here good grass and water, but no wood. This prairie bottom is covered with rich grass, but also with an abundance of prickly pear. From our halt at noon, we travelled four miles farther down the stream, where we found a ford, taking advantage of a point in the river where two islands formed in the channel. Here the water was two and a half feet deep; bottom gravelly and rocky, and current so very rapid that our animals were carried down the stream in crossing. Fortunately, we forded the stream with everything dry and safe. On one of these islands we succeeded in killing a large fat elk, weighing from six to eight hundred pounds; we took about twenty-five pounds of the choice portion, and turned the remainder over to the bears and wolves. After crossing the Missouri we began the ascent of a rough, rugged, craggy ridge of the Rocky range; rocks and stone lay piled to our front, and on each side, in wild confusion. This rough road continued, however, for only a few miles, when we gained a series of prairie bluffs, or hills, which brought us to a very broad and beautiful prairie valley, bounded on each side by mountains. Had we been able to find a ford when first striking the Missouri, we would have entered the southern end of this prairie, and avoided the bad hills referred to; but being compelled to travel down it for several miles, we preferred crossing this ridge, to retracing the same distance on the opposite side, to gain the prairie. The ridge referred to is formed of reddish slate-rock, unstratified; granite, however, was to be seen in broken masses on, and projecting above, the surface of the ground. Game we found more abundant to-day than any day since we left the buffalo country: in the morning we saw two bands of mountain goat, bounding their way over the craggy hills with the swiftness of arrows; in the evening we saw many bands of elk and antelope running over the hills and in the prairie valleys of the mountains. One of our guides, in ascending a high peak this evening, with a glass saw something far in the distance, which he supposed to be a man on horseback. I told him to go and see what it was, as I thought it might possibly be some one from Governor Stevens's party sent out to reconnoitre. Mounting a good horse, he was soon on the road. He returned to camp at night and reported that what he took to be a man on horseback turned out to be a tree. Our camp of this night was on a small stream from the west emptying into the Missouri, lined on each side with an abundance of wood; the grass, however, was very indifferent. The night of this day was clear and beautiful. This prairie is said to connect with Fort Benton by a wagon road; this is at present based upon information from trappers, who have spent many years in the mountains, and who have often passed over the country, between Fort Benton and the Bitter Root valley: they represent that it is necessary to make but two crossings of the Missouri in the whole distance, the road coming in on the north side of this prairie bottom.

September 23, 1853.—Commences very mild and pleasant, the thermometer at sunrise being 42°. We did not resume our march this morning till near 8 o'clock, when our trail lay over the beautiful prairie valley before referred to, which we found eighteen miles wide, crossing in the meanwhile several prairie streams, all of which empty their waters into the Missouri. At 12 m. we halted on a stream coming from the west, finding here good water and wood, but very indifferent grass. Game to-day has been exceedingly abundant. Elk and antelope, which were seen in large bands during the day, loaded our table at eight. In the afternoon our course lay up the valley of a small stream, on which we nooned; we here found the ravine exceedingly tortuous, the rocks along the valley many and rugged, though affording a very good road; the rocks on the side of the hills, which at times were of a dark cream color, at others of a smoky black, broken off and lined up to near the head of the ravine, when it increased to two miles in width, forming a very beautiful pine grove. The hills along this ravine were clad with pines growing to a height of forty feet, and perfectly straight. Our camp of this night was at the foot of the dividing ridge of the Missouri and Columbia waters, on a small brook emptying into the stream, along which we journeyed during the afternoon, where we found good wood, water, and excellent grass. The night of this day was very mild and pleasant. We killed during the day one elk and an antelope, the skin of the latter of which we secured and dried for an apishamo (saddle-cloth) for one of our animals.

September 24, 1853.—Like many of the previous days, commences mild and pleasant. We resumed our march at half-past 7 o'clock, our course being nearly due west, up a steep mountain of the dividing ridge, which was about one thousand feet high, above the bottom of the valley. Our course to its summit was necessarily very winding, from the nature and character of the ground. This mountain, as also the whole range, was well clad, the pine growing in some places perfectly straight, and to the height of a hundred feet. This particular mountain crossed by us was not practicable for wagons; though I am told there is one which, crossing the prairie referred to yesterday, crosses the mountains a few miles farther to the north, by a very easy and gradual ascent and descent, the only obstruction being the timber and the loose rocks and stones.

On the top of this mountain we found a quagmire, in which our animals unfortunately plunged themselves; and it was with some difficulty that they were extricated. Gaining the summit of this mountain, we fell upon a beautiful prairie road, which led us to the headwaters of the Little Blackfoot fork of the Hell Gate river, being a tributary to the Clark's fork of the Columbia. This stream we found well wooded, the cotton-wood and willow abounding principally; the tops of the mountains on each side were clad with pine.

The mountains on our right were formed of a dark gray rock; which, having become very much disintegrated by the action of the frost, lay piled up to the height of many feet. At the foot of the mountains, for many miles, the valley of this fork was from a mile to a mile and a half wide, and covered with a rich growth of very nutritious grass. We nooned on the right bank of this stream, where one of our Indians caught a string of fine mountain trout. In nearly all the brooks and streams that we have met in the mountains thus far, we have found an abundance of fine trout; thus always affording us something for our table in the scarcity of game, which latter we found scarce again to-day, only one or two antelopes being seen in the valley.

Resuming our march, we continued down the valley of this beautiful mountain stream, fording it at a distance of three miles; when, to shorten our distance, we gained the top of a prairie hill, from which we had a fine view far into the distance; crossing, in the interval, several prairie streamlets that flow into the Little Blackfoot fork. We could see several small tributaries coming in from the east, winding through very beautiful prairie valleys; some of these streams being well wooded. Having travelled a distance of twenty-five miles, we camped on a tributary of the Little Blackfoot fork, finding here good wood and water, but not as good grass as we had passed during the day, nor as good as our animals deserved after a fatiguing march. During the afternoon the clouds gathered thick and black in the west, giving promise of a shower, which, towards 9 p. m., came in full blast, continuing till morning, giving us a wet and uncomfortable bed.

September 25, 1853.—Commences cloudy and rainy, the rain having continued the whole night without cessation. Our course this morning lay along a series of hills, some of which were very steep and exceedingly rocky. The rain during the night had caused the ground to become very muddy and slippery. We crossed the Little Blackfoot fork many times, which we found well wooded with cotton-wood and willow; current rapid, and the bottom very rocky, with many rapids. The rain continued during the whole day, which made the travelling disagreeable. The mountains to-day are not so high as those we have passed, but present more the appearance of high undulating prairie hills, with their summits occasionally covered with timber. The formation along some of these mountain prairies was of slate granite and a red brick-colored rock, which, when broken, looked not unlike fragments of broken brick. Our camp of last night was near a ——— of mountain limestone. Having halted at 12 m. to prepare breakfast, we resumed our march at 2½ p. m., continuing down the valley of the Little Blackfoot, which, receiving many tributaries from the mountains on each side, swelled it to a stream of from eighteen inches to two feet deep, and from twenty-five to thirty yards wide, which continues to be well wooded; the quaking asp and small-leafed cotton-wood being found most abundant; elm and ash were also to be found—the latter, however, but seldom.

The valley of this stream is now one mile wide, and covered with a beautiful and luxurious growth of fine grass. In many places the valley has been burnt over, and the young, green grass is now growing abundantly. Our night's camp being near one of these spots, our animals duly appreciated the nutritious grass. We struck, during the afternoon, the main stream of the Hell Gate river, which we found to be a rapid, bold stream, eighty yards wide, with channel water two feet deep, lined on both sides with the small-leafed cotton-wood. We did not follow the Little Blackfoot fork to its mouth, as our trail tended more to the west, over a series of low undulating prairie hills, striking the main stream of the Hell Gate river about three miles below the mouth of the fork. We forded the Hell Gate river a few miles below the Little Blackfoot, camping on its left bank, finding good grass, wood, and water.

The Hell Gate river rises in the main chain of the Rocky mountains; its principal branch flowing through a well known prairie bottom called "Deer's Lodge;" its source being in the ridge of mountains separating its waters from those of the Wisdom river, a tributary of the Jefferson fork of the Missouri; its most eastern branch rising in a ridge separating it from the main stream of the Jefferson river. Both of these branches are followed by Indians going to the buffalo hunt—the former being travelled by a very good wagon road from Fort Hall.

September 26, 1853.—Commences cool and cloudy; the rain ceased near morning, leaving everything wet and disagreeable. We resumed our march at 7.10 a. m. down the valley of the Hell Gate river, on its left bank, continuing at times in the valley over the prairie bluffs that bound it, in order to cut off the many bends of the stream. We crossed the stream several times during the day, finding the ford with water two feet deep, and the stream from eighty to one hundred yards wide. About 11 a. m., when on the left bank of the river, we struck the trail of a party going towards the east—the trail being but a few days old. We found a small pile of stones, and in it a small piece of paper with the following written on it: "F. W. Lander, engineer N. P. P. R. Ex., passed here with nine men September 23, 1853, towards St. Mary's.—Hugh Munroe, guide." His trail tended at that time due magnetic east, while ours was due magnetic west. I thought it possible that the guide of Mr. Lander's party had taken the Hell Gate river to be the St. Mary's or Bitter Root river, and in that case was following it up to strike the St. Mary's village, the point of junction of the several reconnoitring parties then in the field. Laboring under this impression, and knowing full well, from having four Flathead guides with us, that we were travelling on the proper trail and in the right direction, I deemed it expedient to despatch Mr.

Burr and an Indian guide, with directions to follow their trail a reasonable length of time, and if he met with the party, to warn its chief of his error; and in case he could not overtake them, to retrace his steps, and follow on our trail to the village of St. Mary's. To this effect he and the Indian, mounted as well as the condition of our animals admitted, started at 12 m. on their trail. We passed to-day quite a large tributary to the Hell Gate river, coming in from the west-southwest, called the Flint creek, by following which, our Indians stated, led to a road of two or two and a half days' journey to the St. Mary's village, across the Bitter Root range of mountains, but by a much more rough and rugged trail than the one we were then travelling. They stated that the road was by the Gun Flint creek, and is the one travelled by the Blackfoot Indians in the spring, when visiting the Flathead country to steal horses. I thought it probable, therefore, that Mr. Lander's party had taken this road across the mountains, and in that case Mr. Burr could not overtake them before reaching the village of St. Mary's.

Continuing our journey over a series of prairie hills till 2.30 p. m., we encamped on the west bank of the Hell Gate. Here the stream was well wooded; channel-water two feet deep, clear, and the current quite rapid; bottom stony and gravelly.

The weather during this afternoon was cool and cloudy, which, towards the middle of the night, changed to a cold rain, rendering our overcoats very comfortable. Game during this day has been exceedingly scarce; one antelope was all that was seen during the day; at night, however, one elk came near the camp, when three of the party started, one on horseback, in pursuit of him. They succeeded in wounding him, but not so badly but that he escaped. The Indians were exceedingly anxious to capture him, since they had nothing to eat, but were dependent on our bounty, which was necessarily small and limited. Here I am forced to mention the patience and fortitude of these Indians. Here they were, brought from their tribes and homes, and in the midst of their hunting season, to guide and accompany the whites across the Rocky mountains, and when without anything to eat they displayed a degree of Christian fortitude rarely seen among any other class of people; but willingly did we share our scanty fare with them.

September 27, 1853.—Commences cool and cloudy, giving indication of rain; the thermometer at sunrise being 42°. We resumed our journey this morning at 6.30 a. m., continuing our course along the banks of the Hell Gate river, which we crossed five times during the day, finding a good ford at each crossing, with water about two feet deep; the current very rapid and bottom rocky. The stream continued to be well wooded; the valley in places being a pine forest, the trees growing to a great height, and perfectly straight. We found the valley to-day running nearly west, but the stream itself very tortuous, and making large bends. We saw no game to-day. We saw on the road in abundance what is called by some the mountain apple, a small red berry, growing in bunches from six to nine feet high. They looked very much like the apple seen on the rose-bush when the flower has been plucked or withered. The taste is somewhat similar to that of the apple of the States, and when touched severely by the frosts are said to be very good.

The mountains on each side of the valley are still clad with pine; the valley itself being to-day very level, affording a beautiful road; the grass being very good. After a march of twenty-five miles, we encamped on the right bank of the Hell Gate river, finding good grass, wood, and water.

About seven o'clock p. m. the Indian guide who had accompanied Mr. Burr returned, stating that Mr. Burr was back thirty or forty miles. I concluded, therefore, to remain in camp until he should return. The night of this day was mild and pleasant. We passed, about 10 o'clock a. m., a second trail leading to St. Mary's village, which was to our right, being the one followed during the high-water seasons.

September 28, 1853.—Commences cool and cloudy. At 8 o'clock a. m. it commenced raining, which continued during the day, though moderately. We remained in camp to-day; our Indians amusing themselves in fishing and arranging their trinkets, &c., as they were now approaching their village, and wished to show to advantage, both among their own tribe and the whites. The men were engaged in attending to their animals, &c., making moccasins, or boots of dressed buffalo-hide, for those that were lame; this latter we were compelled to do some days back, as several of our horses were tender-footed; being unshod, and crossing the streams so often, the beds of all of which were rocky and pebbly, told upon the feet of our animals. This plan of making boots or moccasins for them we found to answer very well.

About 7 o'clock p. m. Mr. Burr returned. He reported, "that after leaving my trail on the morning of the 26th, he followed on the trail of the horse-tracks which we had seen, which tended north forty-five degrees east; he followed till he came to one of the camps; he dismounted and followed one of their camp-fires, and found the ashes still warm, thereby showing he was not many miles distant from them; that he followed the trail over a very rough, difficult, and rugged road to the top of a high hill, from which he could see far in the distance. Towards the north lay the valley of a large stream, the banks of which were well wooded, the valley well grassed." From his description, I took this to be the Big Blackfoot fork of the Hell Gate river. When gaining the top of this mountain, the Indian refused to follow him farther, but turned his horse's head westward.

Mr. Burr reports, that if his horse had been in good condition, he would have followed them alone; as it was, he was compelled to retrace his steps, and follow the trail of the Indian.

September 29, 1853.—Commences cloudy but warm, thermometer at sunrise being 39°. We resumed our journey at 6.30 a. m. down the Hell Gate river, following along its right bank by a very excellent road, which lay principally through a pine forest of the valley. At a distance of six or seven miles we struck the Big Blackfoot fork of the Hell Gate river, which we found to be a rapid stream, from fifty to sixty yards wide at its mouth, with a rocky bed, and channel-water twenty inches deep. We crossed it about twenty yards above its mouth.

Where the forks come together is a beautiful prairie bottom, well grassed. This place is called the Hell Gate, a name given it by the Flatheads and other Indians west of the mountains, from the fact that here the Blackfeet Indians have committed many murders and robberies; it being the debouch of the defiles of the mountains, and where Indians are generally found, and must pass in going to the buffalo hunt east of the Missouri.

It is a perfect gate in the mountains, forming a well known and noted landmark. From receiving the large volume of water brought down by the Big Blackfoot fork, the Hell Gave river has swollen to a large stream, with a rapid current, and eighty yards wide. At 11.30 a. m. we fell upon the trail of a large party from the Big Blackfoot fork; a short time after, upon the trail of two wheels, with animals shod, which we concluded was the trail of the main portion of the expedition: they had passed this place only the day before, the trail of the wheels being that of the odometer wagon.

At 12 m. we halted on the right bank of the main stream of the Hell Gate river, having travelled fifteen miles, finding here good grass, wood, and water. Resuming our march at 1.30 p. m., we continued for two miles farther along the Hell Gate river; crossing it at a point where formed a gravelly island in the channel, we found the current here quite swift, water about two feet deep, and bottom as above, very pebbly and rocky.

We now entered upon a large and beautiful prairie lying between the Hell Gate and Bitter Root or St. Mary's river, which latter at a distance of three or four miles we struck, finding it a bold, rapid stream, and of the same size and character as the Hell Gate river. We struck the Bitter Root river where it makes a great bend, going to the west, and about eight or nine miles above its mouth.

This river rises in the main chain of the Rocky mountains, is about ninety miles long, and flows through a beautiful valley, where is the residence and home of the Flathead Indians. It is noted for its abundant and rich grass and for its exceedingly mild winters.

Travelling up the Bitter Root river for a distance of six miles, we crossed it, camping on its left bank, finding good grass, wood, and water; our camp being where the main party camped on the night previous. The night was cool, with a heavy frost.

September 30, 1853.—Commences misty and cool, but towards ten o'clock becomes a beautiful bright day.

We resumed our journey, at 7.30 a. m., up the Bitter Root valley, by a very excellent road, crossing several small tributaries coming in from the west, making one crossing of the Bitter Root river about ten miles from our camp of last night. At a distance of six or seven miles farther we halted on a small stream from the east, about three miles below the St. Mary's village, the sight of which we all greeted with feelings of joy. We were visited here by several Flathead Indians, who informed us that "Suryarpees" arrived yesterday, meaning thereby the expedition. Resuming our march, we reached the village at 3 p. m., on the twenty-second day from Fort Benton. Here we were met by the Governor and several members of the expedition, who had expected us in much sooner. Mr. Lander's party, whom we started in search of, arrived safely.

Our Indian delegation was presented to the Governor, who talked with them as the representatives from their tribe, setting forth the good intentions of the government, &c. We were glad to find ourselves at our journey's end.

Taking now a retrospective view of our route from Fort Benton, we saw we had made a great bend, when leaving the Missouri, to the south-southeast, over a line of one hundred and thirty miles, to the Muscle Shell river; thence southeast, over a line of sixty miles; thence westward, across the main chain of the Rocky mountains, to the Bitter Root valley, over a distance of two hundred and twenty-five miles, crossing in the interval the source from whence flow both the waters of the Atlantic and Pacific oceans. In addition to crossing several small streams which empty their waters into the Missouri, we had followed to its head one of its principal tributaries—namely, the Muscle Shell river—crossing the ridge of the mountains from which it receives its source; crossing the Missouri far to the south, near to the gate of the mountains (the great landmark of the country) through which it issues; and thence, across the main chain of the mountains, to the headwaters of Clark's fork of the Columbia. From the dividing ridge of the mountains, and even for thirty miles to the east, I can say, from actual examination, that the route travelled by my party down the Little Blackfoot fork, and thence by the Hell Gate river to the Bitter Root valley, is perfectly practicable for wagon trains. There are, it is true, some obstructions at present, such as timber and loose rocks and stones; but with very little labor it can be made not only a practicable, but a beautiful wagon road. The valley of both the streams mentioned affords the greatest abundance of rich and nutritious grass, and their borders are all well timbered with an abundant supply of wood; thus affording the two great requisites on a wagon road.

Most of the road is over a beautiful prairie valley, which Nature herself seems intentionally to have formed for the passage of wagon trains. It is true that the mountain-streams have to be crossed quite often, but there is a ford at every crossing. The banks are low, and the beds are all hard and covered with pebbles and gravel; thus affording every facility for the passage of wagon trains. There are no mountains to cross—no sloughs, no coulées, or other obstructions.

With regard to the connexion from Fort Benton to within thirty or forty miles of the dividing ridge on the east, I cannot express an opinion from what I saw; but, from information gathered from the hunters and trappers of the mountains, it is said that "there is a practicable wagon road from Fort Benton to the mountains, and across the mountains by the route we travelled," which road crosses the Missouri twice, both places giving an excellent ford with a hard bottom.

Here, therefore, exists in the mountains a broad open pass, through which it is possible that, ere many years shall have passed, a broad emigrant trail will lead from the Atlantic to the Pacific Can it be otherwise? Can the advantage possessed by the Missouri river, flowing as it does through the very heart of our country, proved by actual experiment to be navigable for a distance of twenty-two hundred miles, and which from reliable authority is said to be navigable for light-draught steamers to the foot of the mountains—can it be, I say, that, when we have steamboat navigation from the east to within six days of the headwaters of the Pacific, the advantages possessed by this northern country can be overlooked or lost sight of? Will not the emigrants take the shortest and most direct line to the Pacific? It has been proved beyond a cavil that there is a wagon road from the headwaters of the Mississippi to the base of the mountains, and that there exist through the mountains passes practicable for wagons. In addition to this, the great line and length of water communication from St. Louis to the base of the mountains renders this section especially invaluable in a commercial point of view, and gives it a degree of importance possessed by none other.

Should it prove that the country westward from the mountains to the Pacific is feasible and practicable, I hesitate not in saying that this section may yet prove the great key to unlock to our country rich and hidden treasures, and that will afford to our capitalists an inviting opportunity for investments. It might be said by some that this is nothing new. It is true that these things have been as long as the country has been in existence; but why have we not taken possession of them—why have we not used the advantages that Nature herself placed right at our doors? It it is only because we have not felt the need, the necessity for them until the present; but now we do feel the necessity, and that deeply, of turning to our account not only every natural advantage afforded us, but to improve those natural advantages by artificial ones—in a word, to connect the Atlantic with the Pacific, not only by a water but a land communication. The exertion and enterprise of a private company alone has made known to us the importance possessed by the great river Missouri, extending and pushing their posts farther and farther into the Indian country. As time progresses, they have now reached the farthest confines and limits of the Indian country east of the mountains, and have thus made us aware of the existence of a treasure in the very heart of our country, and which may yet tell upon our public coffers. These men saw the advantages that would be possessed by this river, were it navigable to a great distance above its mouth; knowing full well the ease and economy of thus transporting supplies, and bringing from the Indian country their furs and peltries. With this view they attempted its navigation; success crowned their efforts, and year after year are they repaid a hundred fold for their exertion and enterprise; and now is a single steamer seen following the tortuous channel of the Missouri from St. Louis to a point twenty-two hundred miles above its mouth—a solitary, but, I trust, a sure pioneer of the long line of steamers that may yet be seen ploughing the waters of the Missouri from St. Louis to the Rocky mountains, and be instrumental in arousing our people to a sense of the advantage possessed by us, and which only needs an industrious and persevering hand to be turned to our nation's benefit; and to these men be the credit.

Truly and respectfully, your obedient servant,
JOHN MULLAN.

Governor I. I. Stevens,
In Command of the Northern Pacific Railroad Survey, &c.

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25. Report of the exploration from Cantonment Stevens to Fort Hall and back, by Lieutenant John Mullan, U. S. A.; with his route up the St. Mary's, to and up the Jefferson fork of the Missouri.

Camp Stevens, on the Bitter Root River,
Washington Territory, November 19, 1853.

Sir: I have the honor to report that I herewith transmit a sketch of a reconnaissance from the village of St. Mary's, on the Bitter Root river, to and up the Jefferson fork of the Missouri. I left my camp on this river on the 14th of October last, with the intention of making the connexion between this point and Fort Hall on the emigrant road, taking with me Mr. Owen as guide, there being no Indians at St. Mary's village, save Pierre, the Iroquois. Mr. Owen had represented to me that he knew the route full well between the two points, but after being out six or seven days he totally mistook his road; and, having with me no map or anything to guide me, I was compelled to make the best use of the time and means at my disposal that the circumstances under which I was placed would admit of. I succeeded, therefore, in making the connexion between this point and the Jefferson fork of the Missouri.

I followed up the valley of the Bitter Root river to its headwaters. This valley retains the general character that it possesses at or near the St. Mary's village for a distance of forty-three miles, the width of the valley being from four to seven miles up to this point. The stream is well wooded for the whole distance with the cotton-wood and pine. At the point referred to, forty-three miles from the St. Mary's village, the river forks in two main branches—one coming from the south-southeast, and the second from the south-southwest. My trail lay along the fork coming from the south-southeast. The trail also forks at the point of junction. The trail along the other fork is used by the Nez Perces Indians on their road to the buffalo hunt east of the Rocky mountains. This point is known among the Flatheads as the place of "Many Roads," there being many trails crossing and recrossing each other at this point. From this point the valley of the stream diminishes to its headwaters, a distance of about twenty-one miles, the trail leading over a very excellent road to within six or eight miles of its source, where the trail leads over a somewhat difficult road for two or three miles, crossing what is termed "Ross's Hole mountain," leading to a broad open prairie, surrounded on all sides by mountains. This spot is known among the Flatheads and others as "Ross's Hole," and it is here (which I have from undoubted evidence, as there are men now living at the St. Mary's village who were present at the time) that Messrs. Lewis and Clark first saw the Flatheads as they were encamped on the Bitter Root river. Our road lay over this prairie to the foot of the dividing ridge of the Missouri and Columbia waters, up to which point there is a good wagon road, save the crossing of "Ross's Hole mountain;" which, however, can be avoided by following the bending of the stream through a cañon of the mountains. On our return, I, with a portion of the party, came through this cañon without any difficulty; and, in order to be made a good wagon-road, it needs only to be cleared of timber and brush-wood. The ascent over the divide is very steep, and near the summit somewhat difficult.

The mountain of the divide over which the trail leads is known as the "Big Hole mountain." I think that empty wagons can ascend it, however, with not much difficulty, though, as yet, none have ever crossed it in going towards the east. The descent, however, on the Missouri side, is very gradual and over a most excellent road, leading to a broad open prairie, through which flows a series of streams, forming the Wisdom river of the Jefferson fork of the Missouri. Immediately upon crossing the divide we fell upon one of these streams, which we followed down to the open prairie, which was about thirty miles in width. The geological character of the country up to this point, from the St. Mary's village, is about one and the same; the rocks being principally granite and basaltic rocks out of place. Arriving, however, at the range of hills or mountains forming the eastern boundary of this prairie, the rock changes to a conglomerate formation, having no general direction. This conglomerate rock is formed of rounded pebble-stones and broken pieces of rock cemented together by a calcareous cement. This formation also occurs to a very great extent along the Jefferson fork of the Missouri.

All of the streams forming the Wisdom river are unwooded, save by the willow, except the stream along which our trail lay, which was well wooded with the pine, which, near the summit of the divide, was the spruce and white, growing small and scrubby; but the farther we descended the valley of the stream, the larger and better became the timber, till, reaching near the open prairie, the trees became straight, and growing to a height of sixty or seventy feet, the pine then becoming the spruce and yellow-pine; but little cotton-wood was to be seen along the whole length of the stream. After leaving the "Big Hole" prairie, our trail lay over a very low divide of a gradual ascent and descent to a second prairie, through which flows a second stream tributary to the Jefferson fork, along which we followed till we struck the main fork, or main stream of the fork. The greater portion of this stream leads through a sage plain, or at least for half the distance; this plain, or prairie, being surrounded on all sides by high ridges of mountains. We followed along this stream till it led us to the ridge of mountains forming the eastern limit of the prairie, where the stream enters the cañon of the mountains; our course lay through this cañon, over a very rough and rugged road, for twelve or fifteen miles, leading us at times over very difficult hills, at times down rough and steep declivities, and at times compelling us to take the bed of the river. After passing over this exceedingly rugged road, where the cañon was about three hundred yards wide at its greatest width, we entered into a prairie valley, still following the direction of the stream, which we followed down till we struck the main stream of the Jefferson fork, which we found to be a bold stream of twenty-five yards in width, rapid current, and about three feet deep, unwooded save with the willow. The course of this stream, at the point where we struck it, was north 30° west, which was about a quarter of a mile south of the junction with the tributary along which we had been following; from the junction the stream took a bend to the north 40° east, flowing in this direction till, by its windings through the mountains, it was lost to view. Our course lay up the main stream for a distance of fifteen miles, through a beautiful prairie valley of from twelve to fifteen miles in width, till we arrived at the junction of a large tributary coming in through the south-southeast, winding through a very beautiful and broad, level prairie valley; from this junction the stream bore from the south of west a few degrees, our trail during the meanwhile leading over a very excellent and level road. The valley of this stream was from fifteen to twenty miles in width; the stream along its banks being lined with the willow, growing to the height of twenty feet. No timber was to be seen through the whole valley, save a few scattering cotton-wood trees; at times on the main stream, and at times on some of the small mountain tributaries. We followed up this road for a distance of twenty miles on this stream, (an excellent road,) till it opened into a large prairie, surrounded on all sides by high mountains, many of the peaks being perpetually snow-clad. The stream forks in this prairie, coming from the mountains by two separate and distinct gaps; the direction of one being nearly west, and the other a few degrees south of west. My course tended along the northern branch of the two, which we followed up for a distance of twenty-five miles to its source; making the whole distance travelled up the fork about sixty miles from the point of striking it after having left Wisdom river. The gap of the mountains through which this branch of the fork flows is about five hundred yards wide; the tops and slopes of the mountains on each side were well clad with the pine, growing to a height of fifty feet. It was following up this branch that we first met with ice and snow, some of the small streams being so thickly frozen that our animals passed over without breaking the ice; we had snow about two inches deep in ascending the valley. Following the branch to its source, we arrived at a divide of a very gradual and beautiful ascent and descent, which led us into the southern portion of a large prairie, known and before referred to as the "Big Hole" prairie. This divide is also well wooded with the pine, growing to a height of seventy and eighty feet, and perfectly straight. We followed a small trail over this divide till we struck the main trail, which we had travelled on when we left "Big Hole." We again took the trail, and followed it to our camp of this river. I would remark, that in this "Big Hole" prairie there is a series of boiling springs, where the water issues from the ground so exceedingly hot that you cannot bear your hand in it for a moment. These hot springs are so numerous that the water from them forms quite a large stream, and of a cold, frosty morning the vapor rises from the surface, and as seen from a distance looks like a large cloud of smoke. The grass near the springs is dry and parched, and at a distance gives the appearance of a burnt prairie. I have understood, also, that about twenty-five miles north of the "Big Hole" there is another series of these "hot springs." The water from these springs has no unpleasant taste whatever, though the stones and weeds over which it flows are covered with a green incrustation. On the greater part of the route game is to be seen, consisting of elk, antelope, moose, bear, deer, ducks, and geese. We found very good grass, also, on most part of the route; our animals, however, did not stand the trip well, as they were all weak and had been broken down before they started on the trip. I think the road from here to the Jefferson fork of the Missouri can be made a good road for wagons in going towards the south. Wagons have never as yet passed over this road in going to the south—it being thought, by those living here, perfectly impracticable—though wagons from below have passed over it in going to the north. We had snow when recrossing the "Big Hole mountain" to a depth of three inches. Should the weather be sufficiently mild, I think that this reconnaissance will be followed by one of greater extent and of greater interest.

Truly, your obedient servant,

J. MULLAN,
Lieutenant U. S. Army.

Governor I. I. Stevens,
In Command of Northern Pacific Railroad Survey, &c.

REPORT OF A RECONNAISSANCE FROM THE BITTER ROOT VALLEY TO FORT HALL, THENCE TO THE HEAD OF HELL GATE RIVER, THENCE TO THE BITTER ROOT VALLEY.

Cantonment Stevens, Bitter Root Valley,
Washington Territory, January 21, 1854.

Sir: I have the honor to report, that, in conformity to the paragraph of your letter of instructions, dated at the St. Mary's village, October 3, 1853, directing me "to continue the exploration of the country between the Rocky and Bitter Root ranges of mountains, extending to Fort Hall, to connect with the survey of Colonel Frémont, and northward to the Feather lake, and even to the upper waters of Clark's fork of the Columbia," I left my camp on the Bitter Root river on the 28th of November, 1853, to reconnoitre the country between the Bitter Root valley and Lewis's fork of the Columbia as far as Fort Hall, taking with me as guide Gabriel, the Flathead interpreter; Mr. Adams, artist; and Corporals Rose, Simpson, and Gates, of the detachment left in the Bitter Root valley. The general course intended to be followed was up the Bitter Root valley to its headwaters, thence across the dividing ridge of the Missouri and Columbia waters, crossing the main stream of the Jefferson fork of the Missouri, following up one of its head branches to the dividing ridge of the Snake river waters, to the Snake river valley, or the valley of Lewis's fork of the Columbia; our return route to be governed entirely by circumstances and the character of the season. I have already submitted for your consideration a brief report, giving a general description of the route travelled, the character of the streams, mountains, prominent landmarks, &c., intending that it should be followed by a more full and detailed report, giving a description of each portion of the route followed, the character and features of the immense bed of mountains extending over three and a half degrees of latitude, which, being travelled at such a late season, naturally adds to the already interesting character of the route; together with such information, facts, and incidents as our trip called forth. In order, therefore, to do justice to the description of each point of the route, and lay it before you as we found it, I have made such extracts from my daily journal as will go to show the nature and character of the country, its capability, adaptation to useful purposes, its practicability for wagon trains, and such facts of general interest as a new and unexplored route naturally developed. Owing to many and unforeseen contingencies, straying away of animals, &c., we were unable to make more than seventeen miles of our journey up to the 1st of December, when we camped on the right bank of the Bitter Root river. We started with ten mules and fifteen horses, whose ability to withstand the fatigues of the long journey we very much doubted; but being the best we could then find in our large band of animals in the valley, we determined to undertake the trip with these rather than defer it to a later period, as the season was so far advanced that, should we not take advantage of the present opportunity, we would be compelled to leave the work untouched till late in the spring.

We heard news to-day from the States for the first time since last May, which told of anticipated difficulties with Mexico; but even news of such an interesting character as this had lost much of its interest for us; isolated as we were in the very heart of the mountains, cut off from both East and West, we lost sight of, for the moment, the deep interest that must be felt at home at the prospect of our nation being again engaged in war. But our feelings and interests at present lay in an entirely different quarter and much nearer ourselves. We were travelling over new and untrodden ground, which made our labor a pleasure, and that gave a zest to our every enjoyment.

We passed, during the afternoon, two small creeks coming in from the east—the first called, in Flathead, the Sharkahole, (or the Many-roads creek;) the second, the Fabulous, (or Weeping-child's creek.) The soil of this portion of the valley is principally of a rich dark-colored loam, mingled at times with much sand and gravel, the whole being covered with a growth of rich and luxuriant grass. This portion of the Bitter Root valley, and in fact the whole of the valley from Hell Gate to the two main forks of the river, is well adapted to the purposes of agriculture. Wheat and potatoes have been found to grow here exceedingly well, and there is no doubt that all garden vegetables might be cultivated in rich abundance. Its principal capability and recommendation, however, consists in its fine prairie fields, where can graze thousands of head of cattle and horses. There are now several thousand head of cattle and horses roaming these fine grazing fields; and yet this number seems lost in the broad areas over which nature has so plenteously and bounteously spread such a perpetual growth of rich and luxuriant grass. It has been noted as a somewhat notorious fact, that when other valleys of the mountains are covered with snow, in this valley perpetual spring is found to reign through nearly every year. There are, too, many beautiful mountain streams running through these prairies, which seem to have been intended by nature for some good and useful purpose; and, in my judgment, many years will not elapse before this valley of perpetual verdure will be one villaged valley, teeming with life, bustle, and business. All it now needs to become this is to have the incursions and depredations of the Blackfeet cease, and soon will be seen growing up a rich and animated bourg, extending throughout the whole length and breadth of this beautiful valley. The river, with many bends up to our night's camp, and flowing with an exceedingly rapid current, is well wooded with the cotton-wood and pine—the former being by far the most abundant. This tree, called by some the "tree of the prairie," seems to have been nature's favorite in this section of country. Although a very beautiful tree, it seems to me it would have been far better had nature scattered a little more variety in her distribution of forest trees in this region. From what I have seen of the cotton-wood in this section, it seems to me to be a native of low, sandy soils, not adapted to the growth of any other tree save the pine or the willow, which are its attendants. This tree, which resembles very much the poplar of the States, though smaller, grows almost perfectly straight, and to a height of sixty or seventy feet. The wood is exceedingly soft, and not well adapted to any purpose save that of fuel. It is said, by those who have tried it, to rot after being cut a year or two; totally unlike the pine, its neighbor, which grows to great heights, and is exceedingly durable. We found the mountains on each side of the valley covered with snow from base to summit, though no traces of snow are to be met with in the valley. Several lodges of a Nez Perces camp passed us during the day, on their way to meet the main camp of the Nez Perces Indians, just returning from the buffalo hunt. We expect to meet this camp in a day or two.

Friday, December 2.—Commences mild and pleasant, thermometer at sunrise being 44° Fahrenheit. We resumed our march this morning about eight a. m., our course tending a few degrees east of south, and up the valley of the Bitter Root river, which we crossed twice during the day, finding the current exceedingly rapid, and the ford about two feet deep at each crossing. Like nearly all mountainous streams, its bed is exceedingly rocky and pebbly, its general width being about thirty yards. The valley of the stream we find gradually diminishing as we ascend it, but still continues to be well wooded, the pine to-day appearing in much greater abundance than the cotton-wood. This pine grows to a height of from seventy to one hundred and fifty feet, and perfectly straight. The bark is of a reddish yellow color; the burr or ball being from three to five inches long. The greater portion of this day's journey lay over a succession of prairie fields of the valley, at times passing through small groves and forests of pine. We crossed, during this day, two small streams coming in from the west, and a small creek from the east. At the head of the first one is a large and beautiful lake. The lake is about three miles long and a mile and a quarter broad, its outlet being the small stream emptying into the Bitter Root river from the west. This stream is about twenty-five feet wide, rocky bed, and an exceedingly rapid current. It flows, until it reaches near the base of the mountains, through a beautiful prairie bottom. This lake is at the foot of the mountain on the left. We were attended on this day by "Thom's" camp and several Nez Perces Indians, who were on their way to the mountains for certain caches there hid. This day has been mild, though cloudy and hazy, the thermometer at noon standing at 47°. We made during this day but eighteen miles, intending that this and to-morrow's journey should be short day marches; at the end of which we should have a high snow-mountain to cross, in addition to a journey of about thirty miles.

In the evening, about 7 p. m., we were visited by a gentle shower of rain, the wind blowing moderately at the time from the S.S.W. The night was mild, the thermometer being at 40° at 9 p. m.

December 3, 1853.—Commences pleasant; slightly cloudy; the thermometer at sunrise being 33°. The rain of last night has rendered everything very wet this morning, though the atmosphere is clear and pure. We started on our journey at 8 a. m., still continuing up the valley of the Bitter Root river, which we recrossed six times during the day, the valley diminishing to about one mile in width, till near the headwaters of the stream it diminishes to about five hundred yards. We found the upper portion of this valley wooded with the pine solely, growing to a height of one hundred feet, and many of them being three feet in diameter, and perfectly straight. The river forked just above our camp of last night, one trail tending along the north or east fork. (The southern or western fork was followed by Mr. Tinkham to Fort Wallah-Wallah.) The river we found rapid, and making many bends, for a distance of about twenty miles, when our course tending more to the east, we left the main stream, following along the bed of a small head-branch now dry, which led over a mountain about 1,000 feet high, called "Ross's Hole" mountain. On the summit of this mountain we found snow about two inches deep. Mr. Adams followed the river up along its many windings, passing through the cañon of the mountains, and meeting us in the prairie known as "Ross's Hole" prairie. Our ascent up this mountain was somewhat rugged and steep, but affording a sufficient passage for pack-animals. The road for wagons passes to the left of this. Our descent was nearly as steep as our ascent, though over a much better road, our trail in ascending the mountain being covered during nearly the whole of the distance with sharp and broken fragments of granite-rock, making the travelling bad for the feet of our animals. We met, while crossing this mountain, a portion of the Nez Perces camp passing to the valley of the Bitter Root river. They had with them many animals, and most of them loaded with heavy bales of dried meat and furs. The first we met were old men and women, who seemed, with innumerable children, to form the vanguard. I must say that I have never seen a more miserable-looking set of creatures. Some were blind, some decrepit, some who had seen four-score and ten, and some five-score years. Those who were dried up and withered, and good for nothing else, formed the top pack of an animal already loaded with two bales of dried meat. Thus we met them in the dividing ridge, and the exultation of meeting in such a place with the whites was loud and frequent, and from every small band we met would be heard the word "tucktons, tucktons"—friends, friends. They were anxious to know where we were from and where we were going. Having fully satisfied them, each took his own road.

After crossing Ross's Hole mountain, our road lay across the southern portion of a beautiful prairie, known in this section as Ross's Hole prairie, or simply Ross's Hole. This prairie is about four miles broad and fourteen miles long. The wagon road from Fort Hall leads up this valley, passing over the mountain about twelve miles north of the divide, where we crossed it. In this prairie bottom we found encamped several lodges of the Nez Perces Indians, with large bands of horses. We crossed the fork of the Bitter Root running through this prairie, through which flow two other head branches of the Bitter Root river, the extreme source being about four miles to the east, coming from a range of mountains forming the dividing ridge of the Missouri and Columbia waters. We found the grass up the valley, and especially in this prairie bottom, most excellent. Such prairies as the one met to-day, and to be met with in crossing the mountains in every direction, are called "Holes." In fact, the Rocky mountains in this region are made up of ridges of mountains and patches of prairies, varying from ten to thirty miles in length, and as many in width. In Ross's Hole the grass we found to be about six inches long and quite green. The day has been very mild and pleasant, the genial rays of the sun making everything bright and summer-like; the thermometer at 2 p. m. standing 47°, at 9 p. m. 36°; and during the afternoon we were visited by a slight shower of rain. We made during the day twenty-five miles, and camped on the extreme south branch of the Bitter Root river, where we found good grass, wood, and water. Our camp being only a few yards distant from about twelve or fifteen lodges of the Nez Perces, they were anxious and curious to know our business through this portion of the mountains. We were visited during the night by numbers of them, who sat up talking around our camp-fires till near midnight. They told us they were just returning, with their families, from the buffalo hunt; that they had with them on the hunt about eighty lodges, and that they were on their way to the main valley of the Bitter Root river, where they intended passing the winter. They were very glad to see us, and leaving the next morning they all assembled to bid us God-speed. The Ross's Hole referred to is where Messrs. Lewis and Clark first met the Flatheads on their expedition to the Pacific in 1804. There is a chief among the Flatheads by the name of Moise, who told me that he was present when Lewis and Clark visited their camp in Ross's Hole, and that they took what is known here as the Southern Nez Perces trail (the same that Mr. Tinkham followed to Wallah-Wallah) on their way to the Pacific, following the Bitter Root river to its forks.

December 4, 1853.—Commences pleasant, the thermometer at sunrise standing at 38° Fahrenheit. We were delayed till nearly eleven o'clock, our animals having strayed some miles from camp. By invitation, the chief of the Nez Perces visited our camp, and took breakfast with us. Having, after a long search, found our animals, we commenced our day's march by ascending a very high and steep mountain, known as the Big Hole mountain. The western slope of this mountain we found perfectly clear of snow, affording a very excellent road, though up a very steep ascent. On arriving near its summit we found the snow twelve inches deep; the thermometer, which at its base stood 47°, on its summit stood 36°; we were one hour and a quarter in ascending this mountain. Very fortunately, the Nez Perces, who had just crossed the mountain with several hundred horses, had beaten the road well for us, affording an excellent path till we reached the Big Hole prairie. This mountain is about six thousand feet high, and its summit snow-capped; wagons coming from Fort Hall cross it. The road is very good for loaded wagons in descending the western slope, but in ascending I am of the opinion that it is impracticable. There is no difficulty for empty wagons, however, in ascending it. The descent towards the Missouri side is very gradual—so much so, that were it not for the direction taken by the water, you would think you were passing over almost a level prairie valley. This mountain is covered with the white pine, growing to a height of from fifty to seventy feet. We found the mountain to be of a granite formation, a specimen of which was collected from some broken fragments that lay along the slopes of the mountain. This is the same formation as occurs throughout the Bitter Root valley, with the exception that the mica is not found in such large quantities. We passed several Nez Perces lodges in crossing the mountain, with many animals loaded with meat and furs. This has been a great hunting season with all the Indians, both east and west of the mountain. Hundreds of thousands of buffalo have been slain, and small game—

consisting of antelope, deer, beaver, &c.—has been almost innumerable. The Flatheads, also, who arrived from the hunt a few days before we left the Bitter Root valley, came in loaded with meat and furs. This day has been from 12 m. cloudy, with every appearance of snow, the thermometer at 2 p. m. standing at 36°. After crossing the Big Hole mountain we fell upon a branch of the Wisdom river, which is a tributary to the Jefferson fork of the Missouri. This branch flows through a well timbered valley about two miles in width, and occasionally forming patches of prairie from six to twelve miles in length and three to four in width. It receives many small tributaries running from the mountain ridges on each side in every possible direction. We followed along the main branch of this mountain stream for a distance of seventeen miles, camping on its left bank or a slope of the mountain, which we found clear of snow. From our camp of this night we had a fine view over a large and beautiful prairie, called the Big Hole prairie. Bounding this prairie on the east, and at a distance of twenty miles, lay a high ridge of snow-clad mountains, from which flow in every direction small tributaries to the Jefferson fork of the Missouri. The mountains on the south and west are a range of the Salmon River mountains, separating the waters of Salmon river from those of the Missouri. In this prairie are often seen large bands of buffalo and moose; deer and antelope, also, occur in great abundance. The night of this day was clear and cool, the thermometer at 9 p. m. being at 30°.

December 5, 1853.—Commences cool, with snow, the thermometer at sunrise being 30°. The wind during the night was quite heavy, blowing from the south-southwest; towards 8 a. m., however, it became pleasant, when we resumed our march, which lay across the large prairie referred to yesterday. On the western portion of this prairie we found the snow six inches deep, while no snow was seen on the eastern portion. We crossed several prairie streamlets during the day which flow into the Wisdom river, all of which were frozen over sufficiently hard to bear our animals. This prairie is about fifteen miles wide and fifty long, being hemmed in on all sides by mountains except towards the southeast, where is a gap, through which issues the Wisdom river. After crossing this prairie, at which time our course was 15° south of east, our trail tended along the base of the range of mountains bounding it on the east; our course then becoming east of south. This we followed for a distance of fifteen miles farther, over a very excellent prairie road. Here it struck a small stream from the mountains, where we camped, finding good grass and water for our animals; our fuel consisting of small dried willows, which were the remnants of an old Nez Perces camp. We passed on the road of this day a large rock, (of conglomerate,) which projected from a large bed that formed the western slope of the range bounding the prairie on the east. This conglomerate of rounded gravel-stones and broken fragments of rocks, cemented together by a silicious cement—formed quite a hard rock. We broke from it a specimen, which is labelled No. 13. This same rock we found in very large quantities along the Jefferson fork of the Missouri, being traced for a distance of fifty miles up the main stream and its principal tributaries, where, however, the formation is more water-worn, and occurs in very large beds, forming in some places bluffs one hundred feet high. The formation in the Big Hole prairie is the farthest west that we have as yet seen it. On the stream where lay our camp of this night we found a range of hot springs, where the water bubbles from the ground, issuing from nearly one hundred springs. The stones around these springs we found to be encrusted with a thick coating of lime, and the bed of the stream from which flows the water of these many springs to be covered with a thick, green, slimy coating. The temperature of the water was 132°; its taste is not at all unpleasant, being that of pure warm water. The grass along the border of the stream is dry and parched. These springs are so numerous, and flow so freely, that the water from them forms a large stream, and the vapor arising from it looks, at a distance, like the smoke from a fire on the prairies. There is another range of these hot springs in a prairie north of this, known as "Deer Lodge," which will be referred to hereafter, as it will be on our return-route. In the range of mountains bounding the prairie of Big Hole, and nearly due east from our camp of last night, and about twenty miles distant, is a large mountain lake, six miles in length and four in width, which is set like a gem in the mountains. This lake has no outlet, and is a favorite resort for game. This lake we called Lake Davis, in honor of the Secretary of War. We found during this day a beautiful specimen of greenstone on the range of mountains on the eastern side of this prairie, which is labelled No. 14. This day has been exceedingly mild, the thermometer at noon being 40°; and having a level and beautiful road, we were enabled to make a march of thirty miles to our night's camp, where we found grass, which our tired animals duly appreciated.

December 6, 1853.—Commences clear and cool, the thermometer at sunrise being 20°. Resumed our journey about 10 a. m., being delayed in catching our animals. Our road lay over a series of rolling hills, affording a very good road for the distance of ten miles, where we crossed a small ridge of mountains separating a tributary of the Wisdom river from a more southern tributary of the Jefferson fork of the Missouri. The ascent and descent of the ridge we found to be very gradual, affording an excellent wagon road. After crossing this divide, there lay to our left, and about five or six miles distant, a high range of snow-clad mountains, along the western base of which we travelled, (our course being 25° south of east,) and arrived at a point where the ridge bore more to the east. We found this ridge to be formed of exceedingly hard red sandstone, fine-grained and compact, a specimen of which we collected. After crossing the divide above referred to, our trail led us through a large prairie plain, covered with the artemisia or wild sage, growing to a height of from two to three feet. When passing through here before, a trail led us through a cañon of the mountains, where we found the artemisia growing to a height of eight feet, with a trunk about twelve inches in diameter. This formed part of our fuel at our night's camp, together with a few dried willows. This section is exceedingly barren of timber—none whatever to be seen, save the pine of the mountain top, and at intervals of from fifteen to twenty miles an old cotton-wood tree would spring into view, giving a life-like appearance to an otherwise dreary prairie road.

Game to-day we saw none, save ducks and a few antelopes; we succeeded in killing a single duck, but we found the antelopes so exceedingly shy as to preclude all possibility of approach, though we used every exertion to secure one. We were exceedingly anxious now to meet with some game, as we had nothing but bacon, and very little of that, as we started fully expecting to meet with an abundance of game. This day has been exceedingly warm and summer-like, the thermometer at noon being 53°, but the night was exceedingly cold. At 9 p. m. the thermometer was 12.° We travelled twenty-six miles, camping on a tributary to the Jefferson fork of the Missouri, finding good grass and water for our animals, though no fuel but wild sage bushes and a few dried willows. To our right during the greater part of this day's march lay the high range of the Salmon River mountains, with their snow-capped peaks glistening in the beautiful, clear sunshine. This range of mountains, as seen from the east, is exceedingly beautiful and picturesque. They seem to be formed of an innumerable number of jagged peaks, each vieing with the other in loftiness, and wild but beautiful appearance. We found but little snow on our road of this day; that which was found being on the dividing ridge and along the slopes of the mountains. Nearly all the streams passed were frozen over so hard that our animals passed over them without difficulty. Our camp of this night was on the right bank of a beautiful little stream, a tributary to the Jefferson fork of the Missouri, which is a favorite camping ground with all the Indians and others passing this road. Here is formed by the willows along the stream a natural corrál, which, during the spring and summer season, is always and necessarily taken possession and made use of, as it is here that the Blackfeet ramble from March to October. This is used for the animals, in which they are always picketed. We, however, had no necessity for this, since we supposed the Blackfeet some hundreds of miles distant, and turned our animals loose to graze around the camp. This is a great thoroughfare for the Blackfeet Indians, who, when prowling about the country, perch themselves on the highest ridges of the mountains and buttes of the valleys, whence, during the day, they can have a full view for miles of the country around, and thus see at a distance their prey, which they watch with eagle-eye. At midnight, when everything is still in and around the camp, they descend into the valley, and, in a twinkling, stampede and steal off every animal, leaving the unfortunate sufferers to wend their way homeward on foot. This has been the practice of the Blackfeet for years back, and now they are the dread and scourge of the mountains.

December 7, 1853.—Commences clear but cool, the thermometer at sunrise being at zero. Last night also was exceedingly cool, the air being calm and still; a short time after sunrise, however, it moderated and became a summer-like day. This great difference in the temperature during the night and day is somewhat remarkable; during the day the heated air seems to be confined in the valleys of the mountains, and immediately after sunset it is replaced by a cold current coming from the mountains, thus producing an almost instantaneous change, which at times is exceedingly uncomfortable.

Our course during the earlier part of this day (which was 10° east of south, magnetic) lay over a series of low sandy ridges, covered with the artemisia, growing from three to four feet high. This led us to a beautiful prairie valley about ten miles wide, hemmed in on all sides by high mountains, and through which flows the southwest branch of the Jefferson fork of the Missouri. This prairie is known by the Indians and half-breeds of the country as "Horse Prairie," a name given it from the fact that many years ago large bands of wild horses were seen roaming over it. Our trail crossed the branch referred to, which we found partially clogged with ice; the channel, however, was open, being about two feet deep, with a very rapid current. Many small gravelly islands were to be seen in the river in the distance of two or three miles. To our right, and about eight miles distant, were to be seen two high buttes coming within a very short distance of each other, being on different sides of the valley, which at a distance looks like a gate in the mountains.

Through this gate the southwestern branch of the Jefferson fork of the Missouri flows. Beyond this, to the west, the prairie, widening on each side, becomes nearly circular, but still hemmed in by the mountains. Through the range of mountains bounding it are three gaps or passes: the most northern tends to the Big Hole prairie; the middle one leads to the waters of the Salmon river; the most southern one leading to the waters of the Snake river, or southern fork of Lewis river. This middle gap is the one followed by Lewis and Clark, in their expedition to the Pacific in 1804 and 1805, and which they found impracticable for their route to the Pacific. This southwestern fork of the Jefferson river is the one followed by Messrs. Lewis and Clark, with canoes, during the expedition referred to. Our trail crossing this branch, or fork, led across its valley till we struck the valley of the southwestern branch, which we found to be the larger of the two. This branch flows through a valley about six or eight miles wide. The stream is about sixty feet wide and two feet deep, with a rapid current, and pebbly or gravelly bed. It, like the southwestern branch, is perfectly destitute of timber, save a few cotton-wood trees, growing in clumps of four or five, and at least twenty miles apart. The grass in both valleys is exceedingly fine, and which at night our animals, after travelling twenty-five miles, duly appreciated.

At this junction of the mountain valleys is a high ridge of brownish colored stone, about four hundred feet high, which has been worn by the weather into every possible fantastic shape. Arch, dome, steeple, cave, each has its place in this singular formation. Its upper portion seems to be tenanted by the feathered tribe, while that near the base seems to be formed into numerous caves, where the bear and wolf has each its lodging. Game to-day we saw none, save a few large prairie-hen or heath-cock, and a few white hares with red ears; these latter being much larger than the ordinary rabbit of the East. This place is generally a favorite resort for game; but, unfortunately for us, it seemed to be most scarce when the necessity for it was the greatest. I should mention, however, that we did kill one prairie chicken, which at night, with a cup of tea and hard bread, made us an ample repast. At our camp of this night we found a few cotton-wood trees, which afforded us an abundance of fuel, being to us a pleasant change from the last few nights, when our fuel consisted of wild sage bushes and willows.

Both branches of the Jefferson fork are lined with willow bushes, growing from five to six feet high. On our road of this day we met two Banax Indians, who had just crossed the mountains from Salmon river. They had nothing to eat, and no arms to procure any kind of game. They asked me for a few matches, and seemed perfectly contented. They were two days' march from their village, and had crossed the mountains with a prospect of meeting some of their friends returning from the hunt. Having with them a stray horse, they proposed an exchange with one of mine; but not agreeing in a bargain, we each took our respective routes. These are very fine, intelligent looking Indians; their language is euphonious, and is different from that of any other tribe west of the mountains. Their band at present numbers but a few lodges, having been more than decimated by the ravages of the smallpox and inroads of the Blackfeet. The most of them now inhabit the country near the Salmon river, where, in their solitude and security, they live perfectly contented in spearing the salmon, and living on roots and berries. The night of this day was clear and cool, the thermometer being 27° Fah. at sunset.

December 8, 1853.—Commences clear and pleasant, the thermometer at sunrise being at 23°. The frost last night was very heavy. Our journey of this day lay up the valley of the southeast branch of the Jefferson fork of the Missouri, which valley, as referred to yesterday, is called the "Red Butte Valley," from the fact that there is a range of red buttes bordering the stream on the east, and about twenty miles above the junction of the forks. I crossed the river to examine these buttes, and found them to be composed of red baked clay, mingled with rounded gravel-stones, and the whole so compact as to form quite a hard rock. The formation gave undoubted evidence of the action of fire. The portion of the valley bordering these buttes is formed of a reddish clay, a soil resulting from the washings of these buttes, upon which grows nothing but the artemisia, or wild sage. These buttes, forming a range of about two miles in length and five hundred feet high, constitute a prominent land-mark in the valley; hence the name of the "Red Butte Valley." As we ascended this valley, we found it to increase in width till we arrived at the base of the mountains bounding it on the south, where the width of the valley was about eight miles. It is bounded on each side by ridges of mountains, from twelve to fifteen hundred feet high, and perfectly barren of timber, save on the south, which are wooded with the pine and cedar, growing very small. We found the soil of this valley principally of a yellowish or grayish yellow colored clay, upon which, throughout its whole length, the wild sage grows in the greatest abundance. On the lower and the upper portion of this valley we found the grass to be exceedingly rich, but near the middle nothing growing save the wild sage bushes. About fifteen miles from our camp of last night we found the river for a distance of several miles lined with the cotton-wood, growing to a height of seventy feet. The remaining portion of the river and its several small tributaries are unwooded save by willow bushes. After journeying up this valley for a distance of twenty-two miles, our trail to the south, and at a distance of four miles the river, bending to the southeast, was lost to view, as it wound through the prairie valley in the distance. Our road of this day was exceedingly beautiful and level, but a strong southwest wind blowing in our faces, made the travelling very uncomfortable. When we entered the mountains, we saw a few mountain sheep.

Our course, after travelling up the valley for a distance of twenty-two miles, turned to the south-southwest, and for a distance of six miles we travelled through a cañon of the mountains, in which we found the bed of a stream, now dry and untimbered save with the willow. Our guide, though, told us that our camp would be at the foot of the mountain range separating the waters of the Jefferson fork of the Missouri from those of the Snake river, where we would find a spring and an abundance of wood. After winding through this cañon for six miles, we reach the stream flowing from this spring, which sinks into the ground about two miles north of the divide, which has the direction of nearly east and west. Here the soil is principally clay, mingled with much gravel. On entering this gorge, the mountains on each side were formed of a stratified, friable, light-colored rock, the strata dipping to the southwest at an angle of 75°, the strata being very much contorted. About two miles higher up the gorge this formation again occurs, but the strata are more horizontal, still dipping, however, to the west. This rock is easily wrought upon by the weather, as in very many places along the gorge we found that it had become very much disintegrated. The soil of the whole of the upper portion of the valley is formed of the washings from this rock. Having travelled a distance of twenty-eight miles, we encamped at the foot of the Snake river divide, where we found good grass and wood. The divide being covered with snow, and the wind blowing from it through the cañon with great force, we found the night very uncomfortable. It was with great difficulty our tent withstood the cold and severe gale. The ground being frozen, our tent-pins had but little hold. On account of the high wind of this night, our food was well seasoned with ashes and cinders.

The wind has been blowing strong and steady from the south-southwest since morning, and at night much stronger and colder than at any other time. The night was clear and cool, the thermometer at 9 p. m. being 30°; at sunset 33°.

December 9, 1853.—Commences cold and windy. The wind, which during the last night blew with great force from the south-southwest, at sunrise this morning had not abated in the least, the thermometer being 33°. After travelling about a quarter of a mile along the foot of the mountains separating the waters of Snake river from those of the Missouri, we found the ascent quite steep and covered with snow twelve inches deep. It was with difficulty that our animals made their way through the snow, in some places it having drifted to the depth of three feet. No one had passed over this road recently, so we found no trail or beaten road. We found the weather exceedingly cold on gaining the top of these mountains. The wind blowing exceedingly strong, was directly in our faces, and it, with the drifting of the snow, made travelling very uncomfortable. There was no one in the party whose limbs were not thoroughly benumbed on arriving at the summit of the divide, and each one's face was blue with cold. On gaining the summit, to our right and left were to be seen immense beds of high snow-clad ridges, from the tops of some of which the snow is never absent. Towards the Snake river we could see far in the distance the bed of a lake, which our guide told us was a lake formed by the Medicine Lodge creek; in the distance beyond the lake lay a high range of mountains to the south of Snake river. This mountain, or divide, is much more steep in descending than in ascending. We were compelled to dismount and take the snow on foot. On gaining its base, our course for several miles lay through a winding gorge of the mountains. After travelling down it five or six miles, we fell upon a spring gushing from the side of the mountains, where is the source of the "Medicine Lodge creek," a name given it by the Blackfeet Indians some years ago, when buffalo were found in great abundance west of the Rocky mountains. On a certain occasion, when hunting the buffalo in conjunction with being occupied in stealing horses from their neighbors the Flatheads, Snakes, Banax, and others, the Blackfeet were encamped on this stream, where they built a lodge of trees some sixty feet in height, the spot being selected somewhere near the lake formed by the river. Here they were a long time in preparing and making medicines that should prove destructive to all their enemies. From this fact they called it the Medicine Lodge creek. After striking this creek, our road lay through its valley for several miles, which we found to be very tortuous. Its general width was from a mile to a mile and a half; for a distance of fifteen miles it forms a very pretty prairie valley. The stream is unwooded save by the willow, which grows from ten to twelve feet high. The artemisia or wild sage, however, is found in great abundance. The soil of this valley we found to be principally gravel, and apparently unsuited to the growth of anything save the wild sage, found in abundance through its whole length. It is bordered on each side by walls of an exceedingly hard white rock, unstratified, the whole forming a bed 1,000 feet thick. A few miles further, the geological character of the gorge or cañon entirely changes. This white-colored rock is replaced by a black or dark-colored volcanic rock, from which we secured two very interesting specimens presenting a honey-comb surface, and the whole giving undoubted evidence of the action of fire. Near where these were collected we found a second rock, of a grayish yellow color, compact, hard, and striking fire with steel. The first mentioned formation extends many miles in length, and is different from any rock we have as yet met with. We saw to-day many sheep clambering high on the tops and slopes of the mountains, but so far distant as to preclude all possibility of approach. The tracks of many were also discernible along our pathway. Our guides in descending the mountains did succeed in approaching and wounding one, though not so badly but that he succeeded in making his escape. It is truly wonderful to see these animals travelling along the mountain ridges, climbing rocks and leaping precipices truly awful to regard for a moment. Yet, with the agility and fleetness of a deer, they make their way across these apparently insurmountable obstacles, and seem not to regard them. The enemy they fear the most is the wolf, which often pursues them in bands. When pursued by these, their only safety consists in leaping a precipice or jumping down some deep declivity, where the wolf dare not venture. Nature here comes to their relief; she has gifted them with large strong horns, which in their descent of a steep hill receive the whole force of the blow, and thus protect them uninjured from their enemy. Our guide mentioned that a rule always followed by mountain hunters in shooting them when in bands, is, that if you are at the top of a hill, always shoot the one farthest from you, and the remainder will be sure to make their way up the hill for a short distance, when, stopping to see what has occurred, they afford you a second shot; and if at the bottom of the hill, the same will follow, and they will descend—a freak unfortunate for them, but affording great sport for the hunter. These and a few ducks constituted our game of to-day. After gaining the valley of the Medicine Lodge creek we found the weather to be exceedingly mild, compared to what we found it on crossing the mountains this morning; the thermometer at sunset was 32°, and at 9 p. m. 26°.

December 10, 1853.—Commences clear and cool, the thermometer at sunrise being 22°. Anticipating a long day's march in order to reach wood and water, every one was turned out at an early hour, when we were enabled to make an early start. We had a slight fall of snow during the night, but not enough to cover the grass from our animals. During the early part of the day our course still continued through the gorge of the mountain referred to yesterday, which retained the same characteristic features as already mentioned. The sides of the gorge we found to be mural precipices, formed of honey-combed scoriated volcanic rock, rising to a height of one thousand feet above the valley. Our road still continuing very good, after journeying for a short distance through this gorge our trail turned to the right over a very rough and rugged road, till we gained the summit of a low ridge, which we followed over a very excellent road for a distance of six or eight miles, having had an excellent and full view of the Snake River valley. Leaving the river at this point, we could trace its many windings by the dark line of escarpment of volcanic rock along the side of the mountain gorge. The river issuing from this gorge at a distance of six miles, makes a great bend to the north northeast, and again crossed our trail at a distance of thirteen miles, when we found it to be from twelve to fifteen feet wide, and lined with the cotton-wood tree.

Our road, for a distance of five miles before striking this creek a second time, led through an immense prairie covered with the artemisia, or wild sage, growing two feet high. On gaining the ridge before referred to, we came in view of the "Three Tetons," which we could see far in the east, with their lofty tops covered with the glistening snow, towering high in the clouds. On each side of these Tetons lay a high ridge of snow-clad mountains, of which the Tetons seem to occupy the middle or central portion. The word "Teton" is applied to high, towering and prominent peaks of a mountain range that rises above the remaining portion of the ranges. To our right lay, also, the "Three Buttes," another prominent land-mark in the Snake River valley. The butte farthest to the west and north is the largest of the three, and at present is covered with snow, while the other two are of an equal size, and no snow is to be seen on them. These buttes form, as it were, high and prominent islands in the ocean of prairie by which they are surrounded. The word "butte" is applied "to high elevations of land, too high to be called hills or ridges, and not high enough to be called mountains," and which occur, as a general thing, in a prairie country. The Tetons, on the contrary, occur in a mountainous country in travelling to the south. The Tetons form a very prominent land-mark in the Snake River valley; the Teton to the north being the highest of the three, the one to the south being of an equal height. The mountains in which these Tetons occur have a direction of north and south, and have never yet been ascended. They are represented as being formed of rock from their base as far as they can be seen towards the summit; and the tops are covered at all seasons with snow to an unknown depth. We were told by the guide that there is a beautiful cascade in the mountains where the Tetons occur, having a fall of sixty feet over a vertical wall or precipice. Our trail crossing the Medicine Lodge creek led through an immense sage prairie, extending about twenty miles to the north, to the Snake river on the south, and to the Tetons in the east. Our course at the time was due magnetic east. The Medicine Lodge creek, from where we crossed it, bends to the south, where, at a distance of twelve miles, it forms a lake in connexion with a second stream coming from the Salmon River mountain, a few miles farther to the south, and called John Day's river. This lake is called the Medicine Lodge lake. The soil of the prairie up to, and after crossing the Medicine Lodge creek, for a distance of eight miles, is of a grayish yellow-colored clay, mingled with much gravel, affording, however, a very excellent road. The character of the soil of the remaining portion of the road was completely changed. There it formed an immense sandy desert, which was covered with nothing save the artemisia, which, with its dark, black tops, gave a sombre and gloomy aspect to the whole valley. In places we found the sage desert covered with immense beds of black lava, presenting a scoriated surface, and at times occurring in broken fragments along the road. This rock we found to be very compact; where it occurs in beds it presents a uniform surface, but in fragments a honey-comb vessicular surface, the whole showing the action of fire. This same rock, with the addition of trap-rock, formed the geological character of our journey of this day. Large bands of antelope, many hundreds, were seen to-day feeding along our pathway; but when an attempt was made to approach them they would fly across the sage desert with the fleetness of arrows, preventing all possibility of capture. Many sage hens were seen during the day. Those, in addition to a few ducks, constituted the game of to-day. After leaving the Medicine Lodge creek, our journey for sixteen miles still continued through the sage desert, till we struck a second creek, coming from the range of mountains on our left, and known as the Kamas Prairie creek, a name given it from the fact of the root of the kamas being found and collected in great abundance near its headwaters by the Snake and other Indians. This stream is wooded with willows and a few scattered cotton-wood trees. I took several bearings to the Buttes from the north, and also to the Tetons from the west, these fixing their positions definitely. Mr. Adams has sketched the Tetons as we saw them when first coming in sight of them, and as perceived from the west. This day has been mild, though the sky was overcast during the whole time. The thermometer at sunset stood at 36°, about 7 p. m., when snow commenced falling heavily; the thermometer at 9 p. m. being at 32°. I take the following description of the kamas root, and the manner of preparing it, from the Oregon Missions of Father De Smet: "It is a small white, vapid onion when removed from the earth, but becomes black and sweet when prepared for food. The women arm themselves with long crooked sticks to go in search of the camash. After having procured a certain quantity of these roots, by dint of long and painful labor, they make an excavation in the earth, from twelve to fifteen inches deep, and of proportional diameter, to contain the roots. They cover the bottom with a closely cemented bottom, which they make red-hot. After having carefully withdrawn all the coals, they cover the stones with grass or wet hay, then place a layer of camash, another of wet hay, a third of bark, overlaid with mould, whereon is kept a glowing fire for fifty, sixty, and sometimes seventy hours. The camash thus acquires a consistency equal to that of the jujube. It is sometimes made into loaves of various dimensions. It is excellent, especially when boiled with meat. If kept dry, it can be preserved a long time."

December 11, 1853.—Commences cool, cloudy, and snowing, the thermometer at sunrise being 34°. We found the ground this morning covered with two inches of snow, and the weather giving every prospect of a gloomy day. We resumed our march at 8 a. m., which for a mile lay along the right bank of the Kamas Prairie creek, which we crossed, with water two feet deep. At this point we left the river, which, at the distance of six miles, we again struck where it forms a lake, called the Kamas Prairie lake, which is one mile wide and three long. Our trail, in the mean while, led through the sage desert of the Snake river valley.

Sixteen miles from our camp of last night we came in view of a large lake, which stopped our progress to the Snake river in the direction in which we were then travelling. Here it became necessary to make a detour to the east or west. The road to the right is shorter, but is through a country rough and rugged. That to the left is better. This we took, keeping along the margin of the lake; over, however, a very rocky, sage-covered road, where no trace of a trail had ever been made. Where the high and rugged sage-bushes did not stop our progress, our road was impeded by broken fragments and large beds of black volcanic rock, terrible for our animals' feet.

Travelling along this lake for a distance of six or eight miles, we left it to our right, and in a short time fell upon the main stream of the Snake river, or Lewis's fork of the Columbia, which we found to be from one hundred and fifty to two hundred yards wide, and very deep, with high clay banks, bordered with a slight growth of willow. The guide represented that heretofore the bed of this lake has been a beautiful prairie basin, where every year, up to the last season, buffalo have been hunted and killed, and at times in such large numbers that, among the trappers and hunters of the mountains, it obtained the name of "The Market"—certainly a very appropriate name, for whenever they were out of provisions they always made a visit to this noted spot, and were ever rewarded for their labor. But during the last summer it has changed its character completely. I have supposed that the lake has been formed by the overflow of the Snake river waters, and am confirmed in this belief by the fact that the bed the lake now occupies is represented as having been a basin-shaped prairie, and that during the last season the Snake river overflowed its banks to a greater extent than has been known for many years, from the melting of the snows that fell during the winter of 1852. Besides, it is but a few miles from the lake to the river, and the country intervening is a level sage prairie. Again, in passing from the lake to the river we met with much driftwood, consisting in some places of large trees, carried to a great distance from the bank of the stream, which shows that a great depth of water was necessary thus to transport these large and heavy masses. There is no stream known through the valley that could thus form the lake, and, from the circumstances, I could only suppose that it was formed by the overflow of the Snake river. It might possibly be the outlet of some subterranean stream, but the more probable cause has been mentioned.

The day has been so cloudy and gloomy that we were unable to see the Tetons or the Buttes of the valley. When within five or six miles of the Snake river, we descried on its banks a single lodge; when, being very desirous of obtaining fresh meat, and supposing this to be the lodge of some Indian hunting or trapping, Gabriel, the guide, started to ascertain who its inmates were, and to secure, if possible, enough fresh meat to carry us to Fort Hall. The Indian, with his two boys, were off a short distance hunting, leaving his squaw alone at the lodge. Espying whites travelling towards her lodge, she seized a gun and ran to some neighboring rocks, and there couched herself, expecting some misfortune about to befal her, and resolved to fight to the last. Finding her in this strong place, and her lodge deserted, Gabriel spoke to her in Indian, asking where her husband was. She answered, "Yonder in the field, hunting." Seeing from their conduct they were friends and not enemies, as she had supposed, she emerged from her hiding-place and discharged her gun—a signal for her husband to return—when, in a few minutes, the major-domo was on the ground. It was a lodge of Banax, on their way to the mountains for game, and had stopped here to fish and hunt for their subsistence by the way, and they told us they had nothing but two rabbits which they had just killed. Seeing no prospect of getting fresh provisions in this quarter, we journeyed along the right bank of the Snake river for a distance of a mile, and encamped in excellent grass for our animals, which they very much needed, as the grass of last night was poor and scarce. Our fuel for this night consisted of the different wood brought down by the Snake river during the season of the freshets, and which along the banks is scattered and piled in every direction, The day was mild, though cloudy. The thermometer at sunset was 38°, and at 9 p. m. 32°.

December 12, 1853.—Commences clear and pleasant, the thermometer at sunrise being 34°. The Tetons and the high range of Salmon mountains in the east, covered with their mantles of snow, shone silvery bright this morning, under the genial rays of the sun. All of our animals were found this morning save one; when, a short time after missing him, we espied at a distance our Banax friend leading him along the bank of the river, it having strayed to his band of horses during the night. He was accompanied by his son, who it seemed had turned out at an early hour this morning and caught a number of fine trout, which he brought to our camp and presented to us, in return for which we gave him a supply of tobacco. Our journey of to-day lay along the right bank of the Snake river, still continuing through the immense sage desert already referred to. We found the river to make numerous and large bends, and instead of following the course of the river along its many windings, our trail lay through the prairie, leaving the river to our left. We struck it, however, several times during the day, and found it to be about two hundred yards wide, and in its course having exceedingly many rapids and falls. Its banks we found untimbered save by the willow; and we continued on till we reached a camp, where we found the cotton-wood and cedar in great abundance. The river, during the whole distance travelled to-day, winds through the sage prairie, with high clay banks on each side, with occasionally a low gravelly slope. Along the river we found much drift-wood, in some places piled to the height of many feet. Many islands were to be seen in the river, some of which were formed of solid rock, and rose to a considerable height above the water. This rock, many fragments of which will be seen along the banks of the river, is a black, honey-combed, volcanic rock, the same that has already been referred to us occurring in very many places through the Snake River valley, and which is first noticed after crossing the dividing ridge of the Missouri and Snake river waters.

About twelve miles from our camp of last night we espied a smoke, some distance to our left on the river bank; when approaching it, we found, among the artemisia of the prairie, three or four families of the Root Digger Indians, who were living here on the bank of the river. They were astonished to see us, the children running and scampering through the bushes as if their lives were in danger. These Indians are probably the most miserable of all the Indian tribes, either east or west of the mountains. They had with them no lodges and no food, save a large pile of white-colored roots which they had just dug from the side of the river, and which they seem to feast on with as much contentedness as if they were surrounded by all the luxuries of life. The men were absent fishing. Fish and roots are their only subsistence; and still these people are fat and in good condition, and, without knowing it, we would have supposed their fare to consist of aught else than fish and roots. They all seemed to be living in small corrals, as it were, formed of the artemisia, in which they had a few glowing embers. A few horses and a mule stood near by, who actually seemed to occupy, at least in our estimation, a much higher position in the social scale than these miserable, worthless creatures. Apparently, their sole object in living, and pursuit in life, seems to be to gain a subsistence wherewith to keep body and soul together. Words, in fact, are not adequate to express the deep misery, degradation, and wretchedness of these moral brutes of the mountains. They approach more to the order of the brute creation than probably any portion of the human race on the face of the globe. We had visited their abodes with the expectation of procuring fresh meat; but disgust getting the better of us, as soon as we were made acquainted with our new neighbors we put spurs to our horses and soon left the presence of the Digger tribe, thinking that for once we had entered the wrong market for provisions. We had to-day a fine view of the Buttes and Tetons, the latter being covered with snow. Their glistening tops seemed like silver steeples in the distance. We had a fine view of the country bordering the Snake river to the south. For a distance of six or eight miles it forms still the sage prairie, as to the north, when the ground, rising by a gradual ascent at the distance of fifteen or twenty miles, forms mountain ranges with high snow-capped peaks. Travelling a distance of twenty-seven miles by a very excellent road, we encamped on the right bank of the Snake river, finding here good grass for our animals, and an abundance of drift-wood. The day has been remarkably pleasant; the temperature at noon being 46°, at sunset 34°, and at 9 p. m. 24°.

December 13, 1853.—Commences cloudy, and snowing, the thermometer at sunrise being 30°. We resumed our march at 8 a. m., along the right bank of the Snake river, over a very excellent road. As during yesterday, instead of following the many bends and windings of the river, we took a course leading from one bend to the other, thus shortening our journey by many miles. Having travelled a distance of fifteen miles, we found a crossing of the river where were many islands: here it was necessary to keep up the stream in order to follow the ford, the water to our front and right being exceedingly deep. In crossing, however, some of the animals, instead of following the guide, went to the right, and in a few minutes were swimming and floating down the stream. Directions had been given before the commencement of the crossing, that all the animals bearing packs should be led; but, through neglect, only the animals carrying the bedding were led in, and the rest swam the river, the animal bearing our provisions being among the number, our provisions thus became thoroughly soaked; and, to cap the climax to the already great misfortune, the animals bearing the provisions, on reaching the opposite bank, fell into a quicksand, and thus completed the ruining of them. It was fortunate for us that we were so near a depot, where we could replenish our stores. From the crossing of the Snake river we had an excellent road for twelve miles to Cantonment Loring, five miles above Fort Hall, where we arrived about sunset. The day has been exceedingly disagreeable, raining and occasionally snowing through the whole day, which made the road slippery and hard to travel. Our road on the right bank of the Snake river lay through the sage desert, where we found much of the cactus, or prickly pear. Five miles from Cantonment Loring we entered a beautiful prairie plain, where the grass is very excellent, and, with its numerous streams and brooks running through it, renders it an excellent place for a post of any kind. Arriving at Cantonment Loring, we were most kindly received by Captain Grant, formerly of the Hudson's Bay Company at Fort Hall, who, inviting us into his house, spread before us all the comforts and many of the luxuries of life, and gave us a comfortable bed under his hospitable roof—all of which none more than ourselves could appreciate; and we thus passed the night once more near the abodes of civilization. Here Captain Grant is comfortably situated, surrounded by a happy family, and, with all the comforts and many of the luxuries of life, lives as happily and contentedly as he so well deserves.

December 19, 1853.—Commences clear, but cool; thermometer at sunrise 14°. After resting and recruiting our animals at Cantonment Loring five days, we concluded to return to the Bitter Root valley, intending to pursue a different route to that previously travelled. After striking the main stream of the Jefferson fork of the Missouri, our route lay along the east base of the mountains, following down the main stream of the Hell Gate river. Cantonment Loring, so called in honor of Colonel Loring of the rifle regiment, and occupied in 1849 and 1850 by two companies of that regiment, is located in a beautiful prairie section of the Snake River valley, and about five miles above Fort Hall. The land here is composed principally of clay, of grayish-blue color, mingled with but little sand. It is, however, well adapted to the growth of wheat and potatoes; though I have understood that, from the early frosts, it is badly adapted to the growth of vegetables. The grass here is very rich and luxuriant, and, with its many small ponds, lakes, and streamlets, is well calculated for the purposes of grazing. We heard, while at this place, of the lamentable fate of Captain Gunnison and his party, who, being in command of a Pacific Railroad Exploration, was massacred by the Utah Indians within two hundred miles of Salt Lake City. It caused a feeling of sadness and sympathy in our small party. We sincerely regretted that we could not have been within reaching distance, to have given our assistance and aid to this band of explorers through the mountains, whose pathway through the country of a hostile tribe of Indians was accompanied with peril, danger, and difficulty. This we deemed a fit and proper subject for our government to take notice of, and to visit upon these Indians retaliation, with marked severity. At 12 m. we resumed our march up the Snake River valley, accompanied by Captain Grant, who, in addition to his kindness in affording us the hospitality and comfort of his home, has travelled with us to our night's camp. Journeying up the Snake River valley six miles, we encamped on its left bank; finding here good grass, wood, and water.

The night of this day was mild and slightly cloudy; the thermometer at 9 p. m. being 28°.

December 20, 1853.—Commences clear and cool; thermometer at sunrise 22°. We had a slight fall of snow during the night; it being quite cold, with wind from west-southwest. Journeying a distance of six miles along the left bank of the Snake river, we reached the crossing; finding the river partly frozen over, and the rapid current of the channel carrying down much floating ice, which was from two to three inches thick. Journeying along the right bank of the Snake river through the sage desert, though by a very good trail for the distance of fifteen miles, we encamped, it being our camp of the 12th; about sunset we were joined by two Snake Indians, who were on their way up the Snake River valley to join their main camp.

At sunset the thermometer stood at 21°; at 9 p. m. 24°.

December 21, 1853.—Commences cold and snowing; the snow at sunrise being an inch deep, with the thermometer at 22°. We were delayed till 10 a. m. this morning, searching for our animals that had strayed some miles from camp, when we resumed our march through the sage desert along the right bank of the Snake river. Travelling a distance of twenty-six miles, we encamped on the right bank of the Snake river, finding good grass, wood, and water; the river being frozen over from bank to bank sufficiently hard to bear our animals.

December 22, 1853.—Commences cold and misty; thermometer at sunrise 6° below zero; it was very cold during the night. I had intended to remain in camp to-day, to send back to our camp of the night previous for an instrument left there; but finding the weather now very cold, and in front of us a range of snow-covered mountains to cross, every day became precious, and I concluded to suffer the loss rather than risk being overtaken by severe cold or deep snow in the mountains. Our course continued across the sage desert, passing during the morning the Market lake, which was now frozen over. Our road, instead of following the course travelled on the 10th, led farther to the east, thus shortening our route by several miles. About noon it cleared off, and became an exceedingly beautiful day. Marching a distance of twenty-five miles, we encamped on the Kamas Prairie creek of the 10th. This creek was now frozen over, which was lined with willow and quaking asp. At sunset the thermometer was at 10°, at 9 p. m. 20°, below zero.

December 23, 1853.—Commences clear, but cold, the thermometer at sunrise being 6° below zero. We resumed our march at 9 a. m., our course tending for a distance of five miles along the Kamas Prairie creek, which at this point had a course of north 40° east. Here our course lay through the sage desert, crossing at a distance of ten miles a small stream called the "High Bank creek," a name given it from the fact that near its head branch, or source, it flows through high vertical walls of black volcanic rock—in many places columns. This creek, like the Kamas Prairie creek, we found frozen over sufficiently hard to bear our animals. Many places through the sage desert to-day we found covered with large areas of honey-combed volcanic rock, the same as has been already referred to as occurring abundantly in the Snake River valley. We found the valley perfectly free from snow till arriving near the base of the mountains, where we found it three inches deep. Our course for a distance of five miles lay along the base of the mountains, when we entered a gorge or cañon of these mountains, through which flows the High Bank creek. Here we encamped, having travelled thirty-five miles—not finding a camping ground till we had travelled this distance; and even here we had a miserable camp, wood and grass being poor and scarce. Our bed lay on the snow; the thermometer at sunset being 20°, and at 9 p. m. 10°. The day has been warm and pleasant. No game seen to-day.

December 24, 1853.—Commences cold and snowing, the thermometer at sunrise being 3° above zero, and continues cold throughout the whole day; at noon the thermometer being 22° and still snowing. Our course to-day lay up the cañon of the High Bank creek, which we found to be covered with the artemisia, or wild sage, growing two feet high; the mountains on each side being perfectly destitute of timber, and covered with snow, the cañon being covered with snow six inches deep. The High Bank creek we found to-day to be well-timbered with the cedar, the spruce-pine, and the quaking aspen, the latter predominating. No game or living thing was seen to-day to break the stillness and dreariness of our road. Having travelled ten miles, we encamped at the head of the High Bank creek, finding good grass and water, wood being at some distance, which we packed to the camp. This cañon is travelled by wagons from Fort Hall, having been first travelled by Father De Smet in 1840.

December 25, 1853.—Commences cold and gloomy, the thermometer at 7 a. m. being 14° below zero. Last night was exceedingly cold, with a strong wind from south-southwest, and snowing during the whole night. Thus was Christmas ushered in for us—cold, gloomy, and exceedingly disagreeable. After many delays in camp in finding animals, &c., we resumed our march at 10 a. m., ascending a low ridge dividing the main stream of the High Bank creek from a small tributary, which ridge we followed for three miles, over a very excellent road, though the ground was covered with snow eight inches deep. The mountains on each side continue very high, and all covered with snow from base to summit, their chief characteristic being the entire absence of timber. At a distance of nine miles from our camp of last night, we fell upon the waters of the Missouri river, crossing a low ridge of very easy ascent and descent—so gradual, that you leave the Columbia and strike the Missouri waters without noticing it, were it not for the direction taken by the streams. We were all rejoiced to find ourselves once more on the waters of the Missouri. On the ridge we found the snow twelve inches deep, though it had drifted in many places much deeper. The snow was still soft, and not frozen, as we expected to find it. The day was exceedingly cold; the sun shone quite bright at noon, and though the thermometer was in the sun, it stood as low as 8°, with a strong, cold wind blowing from the south-southwest. After journeying eleven miles we found the cold so intense, that we were compelled to halt and build a fire by the wayside to keep warm. Travelling a distance of sixteen and a half miles, we encamped on a small mountain stream, a tributary to the southeast branch of the Jefferson fork of the Missouri; here we found good grass for our animals, the snow being only six inches, leaving the top of the grass uncovered, which, however, they very soon totally exposed with their hoofs. Here we found the ice twenty inches deep. Our fuel at night was poor and scarce, consisting solely of willows. The thermometer at sunset was 8° above zero; at 8 p. m., 14° below zero. This was by far our most disagreeable day, and all with one accord were willing to remember the Christmas of 1853 in the mountains.

December 26, 1853.—Commences cold and windy, the thermometer at sunrise being 11°. The wind, which had been blowing cold and strong from the south-southwest during the night, continued with unabated force this morning, and so continued throughout the day, drifting the snow, and rendering travelling very disagreeable. Our road to-day continued to be very excellent, with much less snow than we had met with during the last three days. It seems that the farther we travel along the waters of the Missouri, the much less quantity of snow do we find. It is true, that on leaving Fort Hall we did not meet with snow through the whole of the Snake River valley till we reached the base of the mountains; but through this whole ridge or range we found snow, varying in depth from six inches to two feet. This range is reported, as we were told by the guide, as being a range where snow falls early, and at times exceedingly deep. He says that last year, in the month of March, he crossed it, and found the snow three feet deep; many parties, during the same winter, attempted to cross it, and were beaten back by the great depth of snow met with, and the want of water and grass for animals. We crossed to-day several mountain streams, all of which were frozen over; which, when open, contributed their supply of water to the southeast branch of the Jefferson fork of the Missouri. Taking their rise in the mountains, they flow through beautiful patches of prairie, many of which we to-day crossed, where we found the grass exceedingly rich and luxuriant, and the snow only two inches deep, though the mountains on each side of us were still covered with snow, and perfectly destitute of timber, save a range towards the north, which, as seen from a distance, might be termed the "Blue Ridge," being covered with the pine, and presented to-day an exceedingly beautiful blue appearance. The only game seen to-day were two deer, which were frightened up along the road, but quickly took to the mountains, giving us no opportunity for an approach. It continued cold throughout the day, the thermometer at noon being 22° in the sun. Travelling a distance of seventeen miles, we encamped on a small mountain stream, where we found excellent grass for our animals; they were thus amply repaid for their scanty fare of the last few days. Our fuel consisted of small willow bushes. We had intended to cross to-day a divide separating two of the tributaries of the southeast branch of the Jefferson fork of the Missouri from each other; but with the cold, and necessary stoppages along the road, we were unable to travel so far, but camped west of the divide. The greater portion of our road to-day lay through sage plains, where we found the sage in some places six and eight feet high, with trunks from eight to twelve inches in diameter. We had, nevertheless, a very excellent road the whole distance, good for either pack-animals or wagons; the chief characteristic, however, being the great scarcity of timber. Grass we found very excellent—the best we have met with since leaving the Bitter Root valley, and which our animals duly appreciated. Game still continues to be very scarce. The night was cold, with a strong wind from the south, and disagreeable in camp, drifting much snow from the mountains, at the base of which we were encamped. The thermometer at sunrise was 13°; at 9 p. m. 12°.

December 27, 1853.—Commences clear and mild, the thermometer at sunrise being at 8° above zero. The wind, which blew strong from the south during the night, had lulled this morning, and with a clear, bright sky caused everything to look gay and cheerful. The mountains on each side of us shone silvery bright under the warm rays of the sun. We resumed our march at 8 a. m., ascending several low prairie ridges for a distance of five miles, when we arrived at the foot of the divide referred to yesterday. We found these ridges to be well covered with grass; snow about two inches deep; though the mountains on each side are all snow-clad from base to summit. The mountains to our left to-day we found to be composed principally of limestone, while on the prairie ridge are to be seen large masses and broken fragments of honey-combed black, volcanic rock. The valleys between these low ridges were covered with the artemisia or wild sage, growing from eighteen inches to three feet high. Numerous mountain rivulets were crossed running through these valleys, which were lined on each side by willow bushes, growing in some places twelve feet high. Arriving at the foot of the divide, we ascended it by a very gradual acclivity, keeping along the slope diagonally till reaching its summit, from which we had a beautiful and extended view of the mountains on all sides. The sun at this time shone clear and bright, giving us a wide and extended view far in the distance. On every side lay snow-clad mountains—those to the east being timbered, while those in every other direction were perfectly destitute of everything save a coating of snow. Below us, and to the east, were seen small streams, taking their rise in the mountains, and running through beautiful prairie valleys perfectly free from snow. We could see from this point of view the gap of the mountains through which flows the Missouri—the great landmark of the mountains. To the south of east lay a high ridge of timbered mountains, from which flow the waters of the Stinking, and also the waters of the Snake river; while to the north lay other ridges and ranges, from which flow the waters of the Missouri. From the top of this mountain we had truly a grand view—high, snow-clad mountains on every side of us. To the south lay prairies and valleys covered with snow, through which we have been travelling for several days; while to the east lay beautiful prairie meadows, free from snow, through which meandered the numerous mountain streams, all pouring their tribute to the great river Missouri. Here, then, we were to leave the vicinity of snow behind us, and we truly congratulated ourselves at the change—a time we had been looking forward to with much interest. Descending this ridge or divide by a very excellent road, we fell upon the headwaters of a second tributary of the Jefferson fork of the Missouri, called by the Indians "Hooked Man creek." Wagons cross the divide already referred to, but, in order to pass without difficulty, must go more to the south, where the mountains are much less steep, giving a very excellent road. Following down the valley of the Hooked Man creek for ten miles, we encamped on its left bank, finding here good grass, water, and wood, the latter being the quaking asp. Game was very abundant, large bands of deer and antelope crossing our trail during the whole day; many white hare were also seen through the valley of the Hooked Man creek. This vicinity is a noted place among the Indians for game. In the mountains on each side of the valley are to be found in abundance bears, moose, and elk; while, in the valley below, deer and antelope are never absent. It is also noted as being a place where the Blackfeet rendezvous, during the spring and summer seasons, and waylay the traveller on his way to the hunt or emigrant road. This valley is about two miles wide, lined on each side by a high range of timbered mountains, and covered with a rich and beautiful growth of bunch-grass. The day has been exceedingly mild and pleasant, the thermometer at noon being 53°. Unfortunately, to-day my horse fell, breaking the only thermometer left, which will account for the temperature of each day not being given hereafter. The night was very mild and pleasant; we scarcely felt the need of a fire. The ground was perfectly free from snow; the Hooked Man creek was free from ice; and everything indicated that we had entered a milder and warmer region. This stream is timbered by willow bushes, save at one or two places small clumps of the quaking asp were to be seen.

December 28, 1853.—Commences cloudy, with a strong wind from the southwest. Being out of meat, Gabriel, the guide, left the camp early this morning in search of game, having pointed out first the direction to be followed, which was down the valley of the Hooked Man creek, which for three miles had a width of from three to five miles, when it opened into a beautiful prairie plain about fifteen miles wide, extending to the main stream of the Jefferson river, and bounded on every side by high mountains; the base of the range, to the north, being washed by the Jefferson fork of the Missouri, which could be traced for many miles by the dark line of cotton-wood that bordered its bank. This range of mountains separates the Big Hole prairie from the Jefferson river. The Hooked Man creek near its mouth is lined with the cotton-wood. The willow, however, is the principal wood on its banks. Its valley throughout is well grassed, and at present, being perfectly free from snow, looks not unlike a large field of yellow grain. This valley bore north 70° west magnetic. To our left to-day was seen the high rocky range of bluffs or cliffs known as the "Rattle Snake cliffs," a name given them by Messrs. Lewis and Clark. To our front and right lay also a prominent point of a prairie bluff called "Beaver Head," a name given it from the supposed resemblance to the head of that animal. We looked intently, and examined with care, to see if we could discover the resemblance, but in our opinion it resembled aught else than the beaver's head. Game to-day was exceedingly abundant, large bands of antelope and deer being seen in the valley—the latter being the white and black-tailed. Travelling a distance of sixteen and a half miles, we reached the Jefferson fork of the Missouri, which we found frozen along the margin on each side with ice three inches thick, while its channel was open, with a rapid current. Its bed we found rocky and pebbly; its bank, as far as could be seen, being lined with the cotton-wood, growing to the height of sixty feet. Its width was fifty yards, giving us a ford with water two feet deep. Our camp at night was on the left bank of the stream, about 200 yards below the mouth of the Hooked Man creek, where we found good wood and grass. Our camp was where a large band of Indians had encamped two days previous, judging from the camp-fires, &c. These Indians we supposed to be the Banax, returning from the buffalo hunt, and, from the indication left at the camp, that they had an abundance of game. Our camp lay ten miles northeast of the Rattle Snake cliffs, and twenty miles southwest of the Beaver Head—the two prominent and well-known landmarks of the valley of the Jefferson river. The night was exceedingly windy and quite cold. It commenced raining at 8 p. m., but the rain soon changed into snow, with the wind blowing at the time with great force and severity from the southwest.

December 29, 1853.—Commences clear and pleasant. We resumed our march at 8 a. m., which lay north 30° west across the large and beautiful prairie valley of the Jefferson fork of the Missouri, which we left to the right; it then runs north 25° east magnetic, being traced for many miles by the long line of cotton-wood trees along its banks. The valley referred to on the south is about six or seven miles wide and perfectly level, covered with an excellent growth of bunch-grass. There, however, as throughout the valley, the cactus or prickly pear occurs in the greatest abundance. Our trail at times led through patches of sage, though not at all inconveniencing our travelling, for, although we had no trail, we had a level and beautiful prairie. After travelling across the valley for a distance of twelve miles, we fell upon a small creek coming from the mountains to our left, and bordered with the willow. This creek, as told by our guide, is known as Bonneville creek. It was here where a party of Blackfeet, in 1835, seized upon the goods belonging to a portion of the expedition under Captain (now Colonel) Bonneville, of the army, then trapping in the mountains, and strewed over the prairie what they did not carry off. It is known now among the Flathead and Nez Perces Indians as the spot where Col. Bonneville's expedition was robbed. Travelling to the north for a distance of five miles, we struck a second creek, running nearly parallel to Bonneville's creek, and both emptying into the Wisdom river; our road during the whole distance being exceedingly level and beautiful. This second creek mentioned is lined with the willow, cotton-wood, and alder. On its right bank occurs a large bed of greenish-colored slate, which is traceable to the mountains to the north, which by its designation gave character to the soil. Leaving the second creek at a distance of two miles, we reached the Wisdom river, the most northern tributary to the Jefferson fork of the Missouri, and is known among the Indians and half-breeds as the Big Hole fork of the Jefferson river. The head-waters of this stream we fell upon after crossing the Big Hole mountain, referred to when leaving the Bitter Root valley, and which we travelled down for a distance of twenty-five miles. We found it now to be a bold stream, seventy-five yards wide, with a rocky and pebbly bottom, and a rapid current; water about two feet deep, though along the margin, where we encamped, frozen over with ice three inches thick. It is timbered with the cotton-wood, growing in great abundance and to the height of fifty and sixty feet. Its valley is about five miles wide, bounded on each side by high ranges of pine-clad mountains; the river bathing the foot of the mountain on the east, leaving the broad valley on its right bank. This valley is characterized by the great abundance of sage or artemesia, prickly pear, and the exceedingly poor, clayey character of its soil. This same soil characterizes the portion of the valley of the Jefferson fork travelled over. Our camp at night was about eight miles above a high rocky range of cliffs, where the river makes a large bend to the northeast. We found at our camp excellent grass, and an abundance of wood. Game to-day was very abundant, consisting of elk, deer, antelope, bear, hare, ducks, and prairie chickens. A large grizzly bear came this morning within a few yards of our camp, but he took to the brush before we could approach him. We succeeded to-day in killing two elks, which was truly fortunate, as we had not an ounce of meat, and were now eleven days from the Bitter Root valley; so that the night in camp was one of feasting and good cheer. About 300 pounds of meat were packed in camp, and at night were to be seen the most choice pieces of this richly-flavored venison roasting upon sticks around the fire. The weather to-day has been exceedingly mild and summer-like—the night being clear, mild and bright. The Wisdom river, on which we encamped, is the one first taken by Messrs. Lewis and Clark, and travelled up for a short distance, but left from a supposed impracticability to travel up the Jefferson fork of the Missouri; which former, if followed as first intended, would have led them by a direct and practicable route to the Pacific, and saved them from the great suffering and privation met with in taking the Jefferson fork, and which led them by a rough and rugged route to the Salmon river, which really proved an impracticable route to the Pacific. By following this stream for a distance of eighty miles, you reach the junction of its principal forks; the one to the south leads to the headwaters of the Salmon river, by a very excellent road, while the one to the west-northwest leads to the headwaters of the Bitter Root river, whose waters flow into Clark's fork of the Columbia. They are each of equal size and of the same length, but can be travelled in the winter only when the seasons are mild.

December 30, 1853.—Commences clear but cold. The ice made very thick during the night, and even this morning, water standing within a few inches of the fire froze hard in a few minutes. Our camp last night was surrounded by a large band of wolves, who were anxiously waiting till we should take our departure, expecting a rich repast from the great abundance of fresh meat killed yesterday. We resumed our march at 9 a m., continuing up the valley of the Wisdom river for a distance of four and a half miles along its right bank, when, reaching a point where the rocky bluffs formed vertical walls along its brink, it became necessary to cross the river, which we did by a ford, with water two feet deep in the channel. On each side near the banks, however, the river was frozen sufficiently hard to bear our animals. At the bluffs referred to the rock is of a grayish green color, and at a short distance looks not unlike a slate formation, which is traceable for a distance of ten miles up its right bank. It is four hundred feet above the general level of the valley, and dips to the west at an angle of 60°. Two miles from our camp of last night we crossed a small creek, coming from the west, now frozen, lined with the cotton-wood in such abundance that it has gained the name of "Cottonwood creek." Our trail, up to the crossing of the Wisdom river, lay through large patches of sage; in many places, however, burnt over by the Indians. After the crossing, it lay principally over a level and beautiful prairie valley, the general width of which was three miles. The Wisdom river we found to-day to be continuously wooded with the cotton-wood, though much drift pine wood was seen along its bank, coming from the mountain bounding the Big Hole prairie on the north. The grass of the valley we found very good. The soil, however, is poor, being principally a yellowish clay, that bakes in the sun. Along its left bank large areas of rounded water-worn stone were seen high above the level of the bed of the river. We crossed a small creek coming from the east called White Clay Bank creek, a name given it from the great abundance of white clay found on its banks. This formation of white clay occurs also in very great abundance along the main stream of the Wisdom river, in the "Big Hole prairie." Our guide states that he has used it for whitewashing. It is a very excellent substitute for lime. Travelling a distance of thirteen miles, we encamped on the left bank of the Wisdom river, finding excellent grass and an abundance of fuel, consisting of the cotton-wood and drift pine. We passed during the day two old camps of the Nez Perces Indians, where were left their corrals, which they had made in fear of the Blackfeet. This is a noted rendezvous for the Blackfeet Indians, being a general thoroughfare for the Pend d'Oreilles, Flatheads, Nez Perces, and Banax Indians, during the spring and summer seasons. The Blackfeet are sure to meet with some straggling band of these tribes, all of whom they consider their enemies. We passed to-day a spot noted as being the place where, some years ago, forty Flatheads, being on their way to the hunt, espied the whole Blackfeet camp on their way to the Flathead country for the purpose of murder and plunder, when the vanguard of eleven men of the Blackfeet, being some miles ahead, were shot down to a man by the Flatheads, who escaped unscathed, and returned to their homes to prepare for defence. The weather during to-day has been very mild and pleasant, though the night was cold. This, however, is the great characteristic of the weather in this region, warm or mild during the day, and exceedingly cold at night.

December 31, 1853.—Commences clear and mild. Every one turned out at an early hour this morning, and having breakfasted before sunrise, we were enabled to make an early start. The river being frozen from bank to bank opposite our camp, I measured its width, finding it to be sixty-eight yards. The ice was twelve inches thick. The river, a short distance above our camp of last night, made a great bend to the west, and passing through a cañon for three miles, perfectly impracticable even for pack animals. Our trail tended more to the east, passing over a series of low sand ridges, affording us, however, a very excellent road, practicable for wagons. Crossing one of these low ridges, we fell upon a small rivulet, coming from the east, called the Yellow Clay Bank creek—so called from a large formation of yellow clay found on its banks, forming in some places bluffs as high as a hundred feet. The Indians collect this, using it for painting, &c. Travelling a distance of five miles over the ridges referred to, we again fell upon the Wisdom river, which here flowed through a beautiful prairie valley, hemmed in on each side by mountains, in which we found feeding large bands of antelope. The river continued to be wooded with the cotton-wood. The character of the grass and soil of this portion of the valley was the same as that below. Journeying up this valley a distance of three miles, the river made a second large bend to the west, passing through a rough and rugged cañon, impracticable even for pack-animals. A trail however, led over the mountains south of the cañon, and is the one travelled in going to the "Big Hole prairie." At this point we left the river entirely, and followed up the valley of a small willow run, which was from a mile to a mile and a half wide, affording an excellent road. We found the valley had been burnt over recently, showing that Indians had preceded us, probably the Nez Perces. The mountains on each side were high, and covered with the pine to about midway of their slopes. Arriving at the head of this willow river, we crossed low clay ridges, the latter of which formed the dividing ridge of the waters of the Wisdom river and those of the Hell Gate fork of the Bitter Root river. This ridge forms no obstacle whatever to the passage of wagon-trains, as the ascent and descent are both easy and gradual. Arriving on the summit of this divide, we could see to the north a high range of mountains, which the guide pointed out as being the ridge along the right bank of the Hell Gate fork. To our right lay a second but low ridge, which separated a small tributary of the Hell Gate from the main stream, and ended abruptly in a beautiful prairie valley. This ridge, as also the one in the distance, was clad with the pine. On the dividing ridge we found snow two inches deep, though no snow was to be seen in the valley below; the only snow besides this being on the higher peaks of the ridges around us. Leaving this divide, we fell upon a small creek, whose waters flow into the Hell Gate river. Having travelled fifteen miles, we encamped on a small stream running from the mountains to our left, where we found good grass, wood, and water. We entered to-day the granitic region, as shown by the large detached masses and boulders from the mountains passed along the trail after crossing the dividing ridge. The weather to-day has been exceedingly warm and summer-like. We found the weather much warmer on the waters of the Hell Gate than on those of the Missouri. Thus did the close of the year 1853 find us once more on the waters of the Columbia, which we all greeted with feelings of joy, as we now had no apprehension of danger either from cold or the snow. We had all supposed that our labors on the expedition would have been closed before the end of 1853, but we still found ourselves travelling through the mountains in midwinter, apparently with as little concern as if it had been midsummer.

January 1, 1854.—Commences clear and pleasant. We resumed our march at 8 a. m., which continued over a series of low rolling ridges, through whose valley flow small mountain streams, all of which when open empty their waters into a creek called the Spear Fish creek, which, eight miles from our camp of last night, we crossed and found frozen to the bottom. This creek is so called by the Indians, who, some years ago, caught fish from its waters by spearing them. Journeying a short distance from this creek, and crossing a series of low sand ridges, we reached a long, level, and beautiful prairie called the "Deer Lodge," a name given it from the great number of deer found in and near its vicinity. This place is a great resort for the Indians west of the mountains at all seasons, and especially when returning from the buffalo hunt, where they remain several weeks recruiting their animals, finding the greatest abundance of rich and luxuriant grass. Through it flow two large streams—one of which is the main stream of the Hell Gate fork of the Bitter Root river—and a great number of prairie streamlets; thus rendering it an excellent recruiting rendezvous for the Indians with their large bands of horses. It is about fifty miles long north and south, and from twelve to fifteen wide, bounded on all sides save on the east by high pine-clad mountains, the summits of which alone are found covered with snow. A very slight fall of snow covered the valley. It is noted for the very small quantity of snow found on it during the severest winters known in the mountains, which gives it the principal advantage for wintering over the many prairie valleys of the mountains. Its many streams are all lined with timber, consisting of the cotton-wood, birch, willow, and the black-haw. Finding our animals very much jaded by their long march, we concluded to remain here a day to rest and recruit them, where they found an abundance of excellent grass. We saw, when entering this valley, large bands of antelope feeding. These, with a few mountain sheep and goats, seen on the highest peaks of the mountains, constituted the game of the day. We did not exert ourselves to secure any, since we had a great quantity of elk meat with us. The weather to-day has been exceedingly mild and summer-like, at noon being very warm. Travelling a distance of eighteen and a half miles, by a very excellent road, we encamped on the Deer Lodge creek, where we found good grass, wood, and water. We crossed, about two miles before reaching the Deer Lodge creek, another of the same size, called the Rock Bank creek, a name given it from the fact of its passing through a rocky cañon near its head. This last-mentioned creek, together with a small stream called the Yellow Bank, rises in the mountains bounding Deer Lodge on the south from the main stream of the Hell Gate fork of the Bitter Root river. The Deer Lodge creek, which is one of its largest tributaries, near its head is fifteen yards wide, with a rapid current, channel-water eighteen inches deep, and lined near its head with the cotton-wood, but lower down with the willow, birch, alder, and black-haw. The mouth of the Deer Lodge creek was about two miles below our camp of the night. There is a second, and one of the largest tributaries, comes in from the east, and empties into the main stream ten miles below the mouth of the Deer Lodge creek. By following up this tributary to its head, you cross, by a very excellent road, a dividing ridge, and fall upon the main stream of the Jefferson fork of the Missouri, which road is often followed by the Indians to the hunt, thence by the three forks of the Missouri. About four hundred yards from our camp of this night occurs one of the most singular and interesting formations met with on our whole route. It is a conical mound, about thirty feet high, with an oval top, around whose base, from east by south to west, occur innumerable hot or boiling springs. On the top of this mound is a spring of three feet in diameter, down which was thrust a pole twenty feet long and no bottom found. The water boils up from this spring, but does not run off.

The mound is composed of a hard ligniform product, occurring in concentric layers, from one to four inches in thickness. I cannot call it a rock, though it is as hard in most places as rock. On its southern slope occurs an irregular mass of black scoriated rock, that looks not unlike coke, and when broken presents the appearance of, and when lifted gives evidence of, the pressure of iron. It shows that it has undergone great change by the action of intense heat. The surface on the southern slope is incrusted with a white salt about one-sixteenth of an inch thick. Breaking from this mass of scoriated rock a small fragment, I accidentally exposed a bed of this white salt, which apparently extended far into the interior of the mound. It is as white as loaf-sugar, and reduces to a pulverulent state with the fingers; in some places it forms a bed, though yielding readily to the knife. A pound of this salt was secured, with the intention of submitting it to Dr. Evans, the geologist of the expedition, for analysis. The rocks, leaves, grasses, and even the ground over which the water from the springs around the base of the mound flows, are all covered with a saffron-colored incrustation. The prairie, for some distance around and near this mound, is covered with a white incrustation, in some places half an inch thick. The springs occur from east by south to west, while none occur towards the north. This mound occurs in the middle of the long level prairie before referred to and described, forming a prominent and well-known landmark. From the peculiar appearance presented by this mound, and its exceedingly singular formation, I have supposed it to be an extinct volcano, and the opening on the top, now a spring of boiling water, to be its crater. The surface is composed of a substance which occurs in concentric layers, varying from one to four inches in thickness, which I supposed to have been thrown from the crater in a molten state, and naturally assumed the position of the parallel layers, as shown by the formation. Again: the black scoriated rock found on its surface gives indubitable evidence of much and excessive heat, and also shows that it was once in a molten state.

The nearest mountains to this mound are six or eight miles distant, thus forming a permanent and notable landmark in this large, level, prairie valley. I collected here a number of rich and valuable specimens, all of which, together with those already collected, have been submitted to Dr. Evans for examination and description.

January 2, 1854.—Was pleasant, though at times cloudy; the wind blowing moderately from the southwest. We remained in camp to-day on the Deer Lodge creek.

January 3, 1854.—Commences cloudy, with a very strong wind from the southwest, accompanied by a heavy fall of rain, which continued till 7 a. m., when it changed to a severe snow-storm, and continued with great force till 10 a. m., when it ceased, cleared off, and became an exceedingly bright and beautiful day. We resumed our march at 10.30 a. m., which lay along the Deer Lodge creek for a mile, when, crossing this creek, it tended down the valley of Deer Lodge, by an exceedingly level and beautiful road, for a distance of eighteen miles; our course being north 18° west magnetic. In the interval we crossed several mountain streamlets, the waters of which were mostly unfrozen. The largest of these streams, coming from the east, is called the Race Track creek. Eight miles from our camp of last night we had a fine view up the valley to the east, through which flows one of the largest tributaries to the Hell Gate fork of the Bitter Root river, whose stream, swollen by the waters of the numerous prairie rivulets and mountain streams, running through wide and beautiful meadows, could be traced for many miles by the dark line of cotton-wood bordering its banks, which was now two feet deep in the channel, and thirty to forty yards wide; while on its banks are also the willow, birch, and black-haw.

For the greater portion of to-day's journey, the river flows through a broad prairie valley, the northern portion of which is a continuation of the Deer Lodge prairie, which, at a distance of a mile from our trail to the left, formed a plateau about two feet above the general level of the valley, and extending to the base of the mountains, which continue to be covered with the pine, and their peaks with snow. The country to the east, like that on the western portion of the valley, rises gradually for a half-mile from the bed of the stream, and with a very gradual slope forms a broad plateau, which extends to the base of the mountains, at a distance of eighteen miles, the valley diminishing to a width of four miles—the stream then bathing the mountains on the north. Having travelled twenty miles, we encamped on the right bank of the Hell Gate river, two miles above the mouth of the Little Blackfoot fork, its principal and largest tributary. Our road to-day has been exceedingly level and beautiful, being prairie the whole distance.

The grass of the valley continues very excellent. The soil to-day is principally of sand, which we found mingled with much mica, occurring in small glistening scales.

During the latter portion of to-day's march we found the ground covered with two inches of snow. The weather toward evening became quite cold, the wind blowing very strong from the southwest, which continued with much force during the night.

January 4, 1854.—Commences exceedingly cold, windy, and snowing. The wind was very strong during the night, accompanied also by much snow. At midnight it blew so hard that our tents were thrown down, and before they could be put up our limbs were benumbed with cold, compelling us to spend a long, dreary, and uncomfortable night. We were not able to resume our march till 2 p. m., on account of the severe storm. Our animals suffered very much from the snow and cold, and early in the morning they were seen standing around the camp-fires shivering from cold. Our march continued down the valley of the Hell Gate fork on its right bank, crossing it at our camp of last night. Two miles from our camp we crossed the Little Blackfoot fork, the largest tributary coming in from the east. This is the stream that I followed down in crossing the mountains from the Muscle Shell river in September last. Our course, by a very excellent road, continued for three miles farther to our camp—making a march of only five miles—encamping on the right bank of the Hell Gate river, finding here good grass and excellent wood. We crossed during the afternoon the trail leading down the Little Blackfoot fork, which is the main Flathead trail across the mountains. The day, as also the night, has been exceedingly cold.

January 5, 1854.—Commences like yesterday, very cold. We resumed our march at 7 a. m., which for five miles continued on the right bank of the Hell Gate river. The country from the mouth of the Little Blackfoot to the Bitter Root valley having already been described in detail in my report from the Muscle Shell river, I do not here give it place. Travelling a distance of twenty-five miles, we encamped on a small tributary coming from the south, having crossed the Hell Gate river twice during the day. We passed during the day a small creek coming from the south, in whose waters gold has been found, and at whose head is said to occur a gold mine. I intended to stop a day to examine the head of this stream, and the valley through which it flows; but finding the ground covered with snow, and the creek frozen over, I was unable to examine it for the present. Passed to-day the Flint creek from the south, and also the Quagmire creek. Found the snow four inches deep on a level, though in places it had drifted to a depth of from twelve to twenty inches.

January 6, 1854.—Commences clear, but very cold. We resumed our march at 9.30 a. m. The road to-day we found very difficult to travel, the ground being covered with a thick sleet; and, although this was covered in some places with six inches of snow, it made the travelling not only difficult but dangerous. During the day our trail lay along the side of a hill of very steep descent, down which two of our animals fell; one holding on to the brink of the precipice by its forefeet, we were enabled to put a rope around his neck and take off the pack, when, at tempting to lower him gradually down the precipice, the rope broke, rolling him from the top to the bottom, over rocks, stones, and trees; he was so much stunned and injured by the fall that we were compelled to leave him on the road. Travelling a distance of twelve miles, we encamped on the right bank of the Hell Gate river, finding an abundance of fuel, but scanty fare for our horses, on account of the snow. We crossed the Hell Gate river once during the day, finding the channel open, though much broken ice was met with in the ford.

January 7, 1854.—Commences cold, and snowing. We resumed our march at 9 a. m.; crossed the Hell Gate river within two hundred yards of the camp, the channel of which we found open, though there was ice for several feet along the margin, and three inches thick. We had great difficulty in crossing the stream, everything in our pack becoming thoroughly saturated with water, and every one was wet as far as the waist, some being compelled to wade the river. From this crossing there were two trails we could follow—the one leading down the valley, crossing the river several times; the second leading along the side of the hills. I told the guide that we would take the latter, which turned out to be so difficult and dangerous, that I afterwards regretted it. The mountains proved to be very steep, and, being covered with a thick sleet, rendered travelling exceedingly dangerous for both men and animals. Below us was a precipice of one hundred feet; here one of the animals missed his footing and rolled to the bottom. We were enabled to make but eight miles' march to-day, camping on the right bank of the Hell Gate river, where we found excellent grass for our animals. We were compelled to build a large fire to dry our baggage—wet during the crossings. Our chapter of misfortunes now seemed to have commenced; and although we estimated that we were but sixty miles from our main camp on the Bitter Root river, we could form no idea when we should arrive there. It continued snowing the whole night.

January 8, 1854.—Commences mild, and comparatively pleasant. The ice, however, made an inch thick during the night. We resumed our march at 9 a. m., crossing the Hell Gate river within a few yards of our camp, where we experienced much trouble in crossing our animals. The channel was open, with water two and a half feet deep; current very rapid. The margin, however, on each side for several feet was blocked with ice. Our trail, to-day, lay principally through a beautiful pine forest. Travelling a distance of twelve miles, we encamped on the right bank of the Hell Gate river, finding scanty fare for our animals, the snow being from three to six inches deep. The weather has been mild to-day till 7 p. m., when it commenced raining, which continued throughout the night.

January 9, 1854.—Commences mild and rainy, which continued till 8 a. m., partially melting the snow, and rendering our travelling much better than it had been for several days past. I despatched Gabriel, the guide, this morning for our main camp on the Bitter Root river, to have certain preparations made on our arrival. We resumed our march at 9.30 a. m., and at the distance of a mile struck the Big Blackfoot, which we crossed with some difficulty. We made the crossing of the main stream of the Hell Gate river, below the mouth of the Big Blackfoot, without difficulty; and also the crossing of the Bitter Root river, where we found the ice about three inches thick. Travelling a distance of twenty-two miles, we encamped upon the left bank of the Bitter Root river, where our animals were amply repaid for their scanty fare of the last few nights by an abundance of rich grass. The weather, to-day, has been exceedingly warm and pleasant, though towards sunset it became cold, with a slight fall of snow in the valley, while heavy snow-clouds covered the tops of the mountains on each side of the valley. We thus found ourselves once more in the Bitter Root valley, and there was no one who regretted it.

January 10, 1854.—Commences mild and pleasant. We resumed our march at 8 a. m. up the Bitter Root valley, crossing the Bitter Root river with an open channel, and arrived at Fort Owen at 2 p. m., where we were kindly received by the proprietors, the Messrs. Owen. Spending the night under their hospitable roof, we reached our main camp on the next day; finding here that our winter quarters had been completed, corral for animals, and everything built, and the men comfortably in cantonment. Here was camped the whole Flathead tribe of Indians, who were awaiting our arrival. Thus we found ourselves at the main camp after an absence of forty-five days, during which time we had crossed the mountains four times, completely turning the eastern portion of the Bitter Root range by a line of seven hundred miles, experiencing a complete change of climate, and crossing two sections of country different in soil, formation, natural features, capability, and general character. Crossing also, in all their ramifications, the head-waters of the two great rivers, Missouri and Columbia, we had now a fine opportunity to compare the climate and character of the Bitter Root valley with that of the Hell Gate, and others in its vicinity. In the former snow was found from four to six inches deep, while in the latter the ground was perfectly free from snow. It seemed as if we had entered an entirely different region and different climate; the Bitter Root valley thus proving that it well merits the name of the valley of perennial spring. The fact of the exceedingly mild winters in the valley has been noticed and remarked by every one who has ever been in it during the winter season; thus affording an excellent rendezvous and recruiting station for the Indians in its vicinity, and to those sojourning in it, as well as all others who might be overtaken by the cold or snow of the mountains. It is the home of the Flathead Indians, where, through the instrumentality and exertions of the Jesuit priests, they have built up a village, not of lodges, but of houses, where they repair every winter; and with this valley, covered with an abundance of rich and nutritious grass, affording to their large band of horses grazing and space, they live as contentedly and as happily as probably any tribe of Indians either east or west of the Rocky mountains. Its capability in other respects aside from grazing has already been referred to in this report, and is of sufficient interest and importance to attract the attention of and hold out inducements to settlers and others. All that it at present needs is to have some direct connexion with the east or the west, and the advantages that it and the sections in its vicinity possess will be of sufficient importance to necessarily command attention. The numerous mountain rivulets, tributaries to the Bitter Root river, that run through this valley, afford excellent and abundant mill-sites, and the land bordering these streams is fertile and productive; and this has been proved, beyond a cavil or doubt, to be well suited to every branch of agriculture. I have seen oats grown in this valley, by Mr. John Owen, that are as heavy and as excellent as any I have ever seen in the States; and the same gentleman has informed me that he has grown most excellent wheat; and that from his experience while in the mountains he hesitates not to say that here might agriculture be carried on in its numerous branches, and to the exceeding great gain and interest of those engaged in it. The valley and mountain-slopes are well timbered with an excellent growth of pine, which is equal in every respect to the well-known and noted pine of Oregon. The advantages, therefore, possessed by this section, are of great importance, and offer peculiar inducements to the settler. Its valley is not only capable of grazing immense bands of stock of every kind, but is also capable of supporting a dense population. The mountain-slopes on either side of the valley, and the land along the base of the mountains, afford at all seasons, even during the most severe winters, grazing ground in abundance, while the mountains are covered with a beautiful growth of pine.

The provisions of nature here are therefore on no small scale, and of no small importance; and let those who have imagined (and some have been so bold as to say it) that there exists only one immense bed of mountains from the headwaters of the Missouri to the Cascade range, turn their attention to this section, and let them contemplate its advantages and resources, and ask themselves, since these things exist, can it be long before public attention shall be attracted and fastened upon this hitherto unknown and neglected region—can it be that we should have so near our Pacific coast a section of hundreds of thousands of acres that will remain forever untitled, uncultivated, and totally neglected. It cannot be. But let a connexion, and that the most direct, be made between the main chain of the Rocky mountains and the Pacific, (and it can be done,) and soon will these advantages necessarily thrust themselves upon public attention, and open to the industrious and persevering avenues to wealth and of power.

Again: this section connects with another of equal if not superior importance—that of the Cœur d'Alene country, which again connects directly by a beautiful section with the country at and near the Wallah-Wallah; thus showing that from the main chain of the Rocky mountains to the mouth of the Columbia we possess a rich, fertile, and productive area, that needs but the proper means and measures to be put forth and manfully employed to be turned to public and private benefit.

Let the Cascades and Dalles of the Columbia be removed by an appropriation from the government, and we shall have, and that direct, steamboat navigation from the mouth of the Columbia to the mouth of and for some distance up the Snake river, and even to the Kettle falls of the Columbia; and that will give to Oregon and Washington Territories the great keys of wealth and importance, the influence of which will not and cannot be sectional or local, but be felt by all throughout the length and breadth of our land, and that will finally redound to our nation's interest and welfare, to say nothing of the great and paramount advantage to be gained so far as regards the problem of national defence. For, by opening an avenue from the Mississippi to the Pacific, it must necessarily become the great thoroughfare of travel from the two oceans washing the east and west coasts of our country, not only for our own citizens, but Europe on the one side, and Asia, together with the numerous and valuable islands of the Pacific, on the other; will naturally turn the course of their trade and travel for this grand avenue, which must needs therefore be guarded for our nation's safety as well as prosperity; will afford an easy, direct, and expeditious connexion for transporting men and munitions of war to the Pacific in case of danger or difficulty from abroad; and will (we feel the necessity every day) dispense with in a great measure the long, dangerous, and circuitous route either of the Isthmus or by Cape Horn.

Looking back upon our route, we saw we had followed the Bitter Root river to its head, which we found from its mouth to be ninety-five miles long, flowing through a wide and beautiful valley, whose soil is fertile and productive, and well timbered with the pine and cotton-wood; but whose chief characteristic and capability is that of grazing large bands of cattle, and affording excellent mill-sites along the numerous streams flowing from the mountains. The country thence, which is watered by tributaries to the Missouri and its forks, to the range of mountains separating these waters from those of the Snake river, or the south branch of Lewis's fork of the Columbia, is also fertile; but its characteristic feature is the great scarcity of timber for any purpose, the willow and wild sage being used for fuel along the whole route. The geological formation of this section belongs to the tertiary period. The capability of this broad area, however, for grazing, is excellent. It is the great resort, at present, for all Indians in the mountains; the mountains and valleys affording a great abundance of game—consisting of elk, bear, deer, and antelope—while the numerous rivers and streams abound in fish and beaver. The latter are still caught in large numbers on the headwaters and tributaries of the Missouri, but are not so anxiously sought after as in years back, owing to the great depreciation of value in the market east. The whole country is formed of a series of mountain ranges or ridges, with their intervening valleys, all of which are well defined and marked; the decomposition and washings of the rocks of the mountains giving character to the soil of the valleys, which may be termed, as a general thing, fertile. The geological formations along the Jefferson fork, and its principal tributaries, are limestone and conglomerate rock. From the range called the Snake River divide, the whole character of the country is completely changed. Here the geological formation is basaltic and volcanic principally. None of the numerous streams and rivulets flowing from the mountains along the route we travelled emptied into the Snake river; but either sunk into the ground, or formed small lakes in the broad valley of the Snake river. The ground in most places is formed principally of sand, and where large beds of basalt are not found the ground is of a very dry, absorbing nature, through which the water sinks—at times bursting out again. It was somewhat singular that for sixty miles above Fort Hall, along the main stream of the Snake river, we did not cross but one tributary, and this coming in from the south, while none came from the north; all of the streams, as before mentioned, either forming lakes or sinking into the ground. This section is also noted for the great scarcity of timber and the immense plains of wild sage, which is so abundant that it merits the name of the Sage Desert of the mountains. It extends for many miles in length and breadth, forming an immense sea of prairie, whose sameness is only broken by the "Three Buttes" of the valley, which rise like islands in the sea in this broad and barren area. Its whole characteristic might be described in the one word—sterility. From the mountains bounding the Snake river valley on the north to Fort Hall, a travelled distance of one hundred and twelve miles, there is but one fertile spot of ground that could be converted to any useful purpose, and this is found at Cantonment Loring, five miles above Fort Hall. Here the soil is of a grayish blue clay and sand, that might be made use of for agricultural purposes. The grazing here is most excellent.

Our return route to the Bitter Root valley, which lay to the east of the Bitter Root mountains, from the Snake river to the ridge separating the waters of Wisdom river, or the Big Hole fork of the Jefferson river from those of the Hell Gate river, the same general remarks will apply as those describing the country from the head of the Bitter Root river to Fort Hall; a series of mountain ranges, giving beautiful prairie valleys, through which wind streams from the mountain-slopes, that pour their tributaries into the Missouri and its forks. Leaving the ridges referred to, you again enter a different and milder region, through which flow tributaries to Clark's fork of the Columbia. Here the soil is a rich loam; timber is abundant; climate exceedingly mild, even during the severest winter. We entered it on the 1st of January, and snow scarcely covering the ground was to be found in the valley. This section connects with the Bitter Root valley. We thence followed down the Hell Gate river from its head to where it debouches from the mountains, five miles above its mouth, which we found to be one hundred and twenty-five miles long, flowing through a fertile, well-timbered valley, from two to five miles wide, bounded on each side by high pine-clad mountains. Game is found in great abundance in these mountains, being principally elk and bear. Additional description of each portion of the route having already been given, I only deem it necessary to say that both routes travelled are perfectly practicable for wagons, though the return route is by far the better of the two, though from sixty to eighty miles longer. I regretted that I could not have made a barometrical profile of the two routes, but this resulted from the fact that a barometer could not be dispensed with in the Bitter Root valley, where was being kept a regular series of meteorological observations, to ascertain the character of the winter in this region. Such points of the route that were of sufficient interest and importance to be noted particularly were faithfully sketched by Mr. Adams, the artist of the party, to whom I am indebted for the accompanying sketches.

Truly and respectfully, your obedient servant,
JOHN MULLAN,
Lieutenant U. S. Army.

Governor I. I. STEVENS,
In Command of Northern Pacific Railroad Exploration and Survey.

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26. REPORT OF ROUTE FROM CANTONMENT STEVENS TO FORT BENTON AND BACK, BY LIEUT. JOHN MULLAN, U. S. A.

CANTONMENT STEVENS, BITTER ROOT VALLEY,
April 2, 1854.

SIR: I have the honor to report, that in conformity to your letter of instructions to continue the exploration of the country between the Rocky and Bitter Root ranges of mountains, and the examination of the mountain passes between the 43d and 49th parallels of latitude, I left the Bitter Root valley on the 1st of March to examine a new route thence to Fort Benton, on the Missouri, and to ascertain its practicability for a railroad route, as also the passage of wagon-trains; and at the same time to obtain a knowledge, from actual observation, of the depth of the snow and the character of the mountains generally at that season.

Lieutenant Grover, in crossing the mountains in the month of January, had an opportunity of ascertaining the depth of snow up to that period; and I thought it adding another link to the chain of knowledge of the mountains to ascertain their character at a period two months later. I was led to believe, by information gained from the mountaineers and trappers in this region, that there existed a road from the Falls of the Missouri to this valley over which wagons could pass without difficulty; and having passed over and examined one hundred and twenty miles of the route in September, 1853, and found it practicable for a wagon-road, I placed full confidence in the information, and started with the intention that, should the route upon examination prove practicable, to bring with me a wagon from Fort Benton to this valley. And I have the honor now to report that I have been perfectly successful, and have found in the mountains a wagon-road, the advantages of which are equal, if not far superior, to any existing across the mountains. I had also determined to examine the country immediately along the Missouri from Fort Benton to the point where I crossed the Missouri in my examination from the Muscle Shell across the Rocky mountains, in September, 1853, which up to this time had remained unexplored, save partially by Mr. Tinkham, in November, 1853. My working party consisted of a half-breed Cree, who was my interpreter, and four of my own men. My route to Fort Benton lay up the Hell Gate river to its junction with the Little Blackfoot, thence up the Little Blackfoot across the mountains. Arriving at the forks of the Little Blackfoot, I found the snow ten inches deep; and knowing there were two passes, one to each fork, I took the more southern of the two. I thence struck for the Missouri river, and examined the line of bluffs along its left bank, that extend from about thirty miles above the falls to near the three forks of the Missouri. I found these bluffs very rough and rugged, affording us a very difficult road even for my pack-train. In a word, it is one immense bed of mountains, extending along the Missouri for one hundred and fifty miles, and fifteen miles wide, necessitating the case of a road being to their north. These bluffs are mostly well wooded with an abundant and large growth of pine. The rock found through them is mostly granite. At this point the Missouri flows mostly through a mountain defile with a rapid current, and in many places very deep and narrow. Leaving the bluffs, through which I travelled three days, we crossed the Missouri, in order to avoid the numerous and difficult coulées extending along the left hank of the Missouri from the bluffs to Fort Benton. But I found the country to the south immediately along the Missouri but little, if any, better than that to the north. In places it is much cut up by very deep and rugged coulées, that are impracticable for anything save a pack-trail. I arrived at Fort Benton on the morning of the 14th. On the morning of the 17th I started on my return to this valley, bringing with me a wagon, with a four-mule team.

I saw that by keeping on the high table-land between the Teton and Missouri rivers, I might avoid the many coulées that make from each of these rivers, and thus gain an excellent wagon road. This turned out to be the case, and from Fort Benton to the Sun or Medicine river I found a perfectly level prairie road. My route thence to the Dearborn river lay a very few miles to the south of that followed and examined by Lieutenant Donelson, in September, 1853.

Presuming that officer has already reported upon the general character of that section, I pass over it, simply remarking that I found a beautiful road for my wagon.

From the Dearborn river my course lay more to the south of west than that followed by Lieutenant Donelson; and at a distance of fifteen miles from the Dearborn struck a stream that rises in the main chain of the Rocky mountains, and is known among the Indians by the name of the Small Prickly Pear creek.

The country between these two streams is a rolling prairie, which afforded us an excellent road. The valley of the Small Prickly Pear creek, which is half a mile wide, I found well wooded with the cotton-wood and willow. Here the fallen timber was the first obstacle met with from Fort Benton, a measured distance of one hundred and twenty-four miles. I found it necessary to remain in camp to-day, and with my party make the road. In eight hours every obstacle was removed, and resuming our march, the day following we found the road very excellent. At this point you will observe, from the accompanying map, that my trail left the river, tending to the north. This was not necessary, as an excellent road lay up the valley of the stream; but, as it would have been necessary to make a road through the timber, which would probably have delayed me another day, I preferred leaving the river and following an Indian trail that led to the northwest, and which fell upon the river a second time. A large party, however, would find it to their advantage to follow up the valley of this stream, for when striking the stream a second time, I found that my route on this day would have been shortened by six or eight miles; and on the next day the same thing occurred, when I again left the river and followed for a few miles in a southwesterly direction, when, by following the river valley, my route would have been more direct for the mountain pass, and would have shortened my distance twelve or fifteen miles. There are two parallel low mountain ranges, or bluffs, through which are two gaps where this stream flows, by following which you reach the mountain from Fort Benton without any difficulty or obstacle save the timber, which, being small and scattering, would be cleared out in two days by six men. Leaving the Small Prickly Pear creek to my north, and at a mile distant, the country thence to the mountains is a rolling prairie. On the seventh night from Fort Benton I encamped at the foot of the mountains on the east, forming the dividing ridge of the Missouri and Columbia waters. The day following I crossed the mountain with no difficulty whatever; found no snow upon its summit, and the mountain itself nothing more than a low prairie ridge. The ascent and descent are so exceedingly gradual, that not only was it not necessary to lock the wheels of the wagon in descending, but it was driven with the animals trotting. One could scarcely have believed that there existed such a beautiful and easy pass in the mountains. For a railroad it would involve a cut of one hundred feet deep, and half a mile long, which was the measured distance from base to base. From the mountains I followed down the northern branch of the Little Blackfoot, thence by the Hell Gate river to the Bitter Root valley, where I arrived on the 27th of March, and at Fort Owen on the 30th, making the travelling time, with my wagon, twelve days from Fort Benton to Fort Owen.

I ran an odometer line over the whole route, and found it to be only forty-four miles longer than that followed by the train under Lieutenant Donelson. I was favored with much beautiful weather during the whole time, finding no snow save at the head of the Little Blackfoot, and on the summit (ten inches) when going; no snow east of the mountains; and I found no snow whatever on my whole return route. I was enabled, also, on this tour, to fix accurately many points of the streams crossed by the main party to the mountains, having passed much nearer the Missouri than Lieutenant Donelson; especially the Dearborn river and the Crown Butte creek, which latter does not empty into the Missouri, but which with a smaller stream forms a lake, the outlet of which sinks into the ground five miles to the north of the Missouri. I was enabled to make the trip in the short time mentioned, having with me animals in fine condition and in good working order. Accompanying this you will find sketches of the principal features of the route, among which is a panorama sketch of the main chain of the Rocky mountains from the Marias Pass to the pass crossed by my party. Also, as viewed from the east, a sketch of my camp at the Bear's Teeth, on the Missouri. This is a prominent and well known landmark in the bed of bluffs along the Missouri; and the sketch is characteristic of the country, as also of the Missouri, as it flows through the bluffs. Also, a sketch of the Missouri River mountains, from the Little Blackfoot Pass. The point where the Missouri leaves the bluffs referred to, is the "Gate of the Mountains," so called by Messrs. Lewis and Clark in 1804. The route I passed over on my return, and examined, I can therefore report as perfectly practicable for a railroad route, and for a wagon road forms an easy and beautiful link in the chain extended and examined by you from the Mississippi river to Fort Benton, on the Missouri. The route is well wooded and watered, and there is an abundance of excellent grass the whole distance, the quality and quantity of which were shown by the fine condition of my animals on their return. I lost no animals on the trip, a distance of nearly six hundred miles, and in a season heretofore deemed impracticable for travelling in the Rocky mountains. From Fort Benton to the mountains, the route lying over a rolling prairie country, would for a railroad involve cuts not deeper at any point than one hundred feet. From the mountains to the Bitter Root valley, you have a gently sloping valley the whole distance. I do not here make mention of the character of either the Little Blackfoot or Hell Gate rivers, having already given you a full and detailed description of each of these streams, their valleys, capabilities, &c., in my report of January 21, 1854. There is still another pass between this last described and the one followed by Lieutenant Donelson, which I intend to examine. The existence, therefore, of this pass in the mountains, with beautiful approaches on either side, must necessarily throw additional light upon the character of this region; and being travelled at the period we crossed the mountains, and finding no snow whatever, will show to many not otherwise properly informed, that this region is not the

Siberia of America that it has often been represented to be. The winter has been remarkably mild. In the Bitter Root valley, at no time has snow been deeper than four inches; and even this from several falls of snow. On my arrival at Fort Benton, and from my own observation, I have been informed of the exceedingly mild character of winters having but little snow, and comparatively little cold. Having made full and detailed notes of each point of the route—in fact, of the two routes—I will be enabled to make you a more full and detailed report, should it be at all necessary.

Truly and respectfully, your obedient servant,
J. MULLAN,
Lieutenant U. S. Army.

Governor I. I. STEVENS,
In Command of N. P. Railroad Exploration and Survey.

H.

ITINERARY.

27. ITINERARY OF THE ROUTE FROM ST. PAUL TO FORT UNION, BY A. W. TINKHAM.

OLYMPIA, WASHINGTON TERRITORY,
March 11, 1854.

SIR: I have prepared, and herewith submit, an itinerary of the route pursued by the train from St. Paul to Fort Union.

I am, sir, very respectfully, your obedient servant,
A. W. TINKHAM.

Governor ISAAC I. STEVENS,
Chief N. P. Railroad Exploration, Olympia, W. T.

		Miles.
June 2, 1853.—Camp in the vicinity of St. Paul, one and a half mile from town, on old St. Anthony road; owing to our nearness to the town, grass poor and wood scanty; water obtained from a house near by	...	1½
June 3.—By the St. Anthony road; pass over green, fertile prairie, with rich, dark soil, or between cultivated fields, to St. Anthony; in about five miles the road approaches the Mississippi river, and thence forward to the town winding along its bank	7½	
Winding parallel with the Mississippi, road runs through fertile prairies and oak openings; reaching Rice creek, crossed by a good bridge	7½	
Camped on a small brook; wood and grass good; water good and convenient; soil sandy	2¼	
		17¼
June 4.—Continuing through prairies or oak openings, with a good road; cross Crow creek, a small stream, by a miserable bridge	3¾	
Through oak openings, with tamarac swamps in sight some two miles to the right of road; road reaches Rum river, a river some one hundred and twenty feet wide, and supplied with a ferry	5¼	
Through prairies and oak openings, with scarcity of water, lighter and often sandy soil, to camp on small rivulet about half a mile from the Mississippi; wood and water good; grass in the low lands near Mississippi luxuriant	11	
		20

June 5, *Sunday.*—In camp; showers of rain; black flies excessively annoying, so thickly besetting the mules as to endanger them.

June 6.—Passing over rolling prairie, the road touches on Elk river, flowing some sixty feet or so below the level of the road, crossing the river with a good bridge about four miles and three quarters from camp; river some ninety feet wide..... 4¾

With little change of the character of the country, either prairie or oak openings, easy rolling ground; road passes on the south side of Big lake—a deep, pretty lake, scantily wooded.......... 5¾

Rolling prairies, with occasionally a wet meadow in the vicinity of the road, and without any running brooks; thence forward to camp on the edge of a small lake, half a mile north of the road, furnishing wood, water and grass, all good; flies troublesome to the animals; should have camped sooner had there been wood and water on the road; soil throughout the day vegetable mould, one to four feet in depth, resting on a sand or gravel substratum.......... 12¾

23¼

June 7.—Prairie open and unwooded, or with scattering scrub-oaks; tamarac swamps several miles to the right of the road; cross Elk river a second time, by a miserable bridge.......... 4½

Cross Elk river a third time, by a miserable bridge; probably since replaced by a good structure, as also is likely at the crossing above; stream small now, about forty feet wide.......... ¾

Prairie to a hill about half a mile across.......... 5½

Prairie to a small brook; Mississippi river has now been within a short distance on the left of the road for some two miles.......... 4

A wooded ridge near by on the right; road passes under this and near the river, to Mr. Russel's, a short distance above Sauk rapids.......... 2

17

Camp in immediate vicinity of Mr. Russel's; wood scarce; water from the Mississippi river—grass fair.

June 8.—Lying in camp, waiting; rainy.

June 9.—Ferried across the Mississippi river, here some six hundred to eight hundred feet wide—boating the camp equipage, provisions, &c., and swimming the animals; through rich and fertile prairies, variegated with the wooded banks of Sauk river a short distance on the left, with the wooded hills on either side, the clustered growth of elm, poplar and oak, which the road occasionally touches; following the "Red River trail," we camp at Cold Spring brook, with clear, cool water, good grass and wood.......... ... 18

June 10.—Cold Spring brook is a small brook about ten feet across, flowing through a miry slough, which is very soft and deep, and previous to the passage of the wagons had, for about two hundred feet distance, been bridged in advance by a causeway of round or split logs of the poplar growth near by; between this and the crossing of Sauk river are two other bad sloughs, over one of which are laid logs of poplar, and over the other the wagons were hauled by hand after first removing the loads; Sauk river is crossed obliquely with a length of ford some three hundred feet—depth of water four and a half to five feet; goods must be boated or rafted over, the river woods affording the means of building a raft; camped immediately after crossing; wood, water, and grass good and abundant. ... 6

June 11.—Over rolling prairies, without wood on the trail, although generally in sight on the right or left, with occasional small ponds and several bad sloughs,

across which the wagons were hauled over by hand to Lake Henry—a handsome, wooded lake; good wood and grass; water from small pond; not very good.....	...	19½
June 13.—Passing over rolling prairies to a branch of Crow river, the channel of which is only some twenty feet wide and four or five feet deep; but the water makes back into the grass one hundred feet or more from the channel as early in the season as when crossed by the train; goods boated over; wagons by hand and with ropes; no wood on the stream; several small lakes, not wooded, are on	9	
either side of the trail, with many ducks, geese, and plovers on them; encamp at Lightning lake, a small and pretty lake, sufficiently well-wooded on the borders for camping purposes; good water, wood, and grass, and abounding with fish....	9¾	
		18¾
June 18.—Over rolling prairie with small pools and marshes, to a swift running stream, about twenty feet wide, three feet deep, a branch of Chippeway river; heavily rolling ground, with stony knolls and granite boulders, to White Bear lake,	6¼	
a large, handsome lake, with mingled open and woodland....................	5	
Broken rolling ground to camp, a mile off the Red River trail, and near a small wooded lake; two small brooks have to be crossed in the interval, and being somewhat deep and with abrupt sides, are troublesome crossings; to where wagons left trail..	6¼	
		17½
June 20.—Rolling prairie country, with small marshes and ponds, to a tributary of South Branch; swift running stream, gravelly bottom, fifteen feet wide, three to four feet deep; with care in selection, good crossing was obtained for the wagons; a wooded lake is a short distance to the right of trail........................	4¼	
Small rivulet, whose banks are marshy and soft..........................	½	
Prairies, with small marshes and ponds, to a swift-running brook, six feet wide..	3	
Prairie to Pike lake, and camp of Lieutenant Grover, a handsome lake of about a mile in diameter, said to abound in pike; well wooded on its south border; grass, water, and wood, for camping, abundant and good..........................	1¾	
		9½
Rolling prairie, with knolls; several ponds and marshes with an intervening brook about six feet wide, and rather difficult of passage, from the abruptness of its banks, to a small brook, the outlet of a small and partially wooded lake or pond..	3½	
Rolling prairie, with grassy, swelling knolls, small ponds and marshes, to Chippeway river; camp of odometer wagon on edge of river; water and grass good; no wood	6¾	
		10¼
June 24.—Crossed Chippeway river, one hundred and twenty-four feet wide, three to six feet deep; goods boated over, and the animals swimming; wagon hauled through the water by a rope attached to the tongue, and with the aid of the mules; camped on Elk lake, a small and pretty lake, well wooded, and with luxuriant grass; good water..	½	
June 25.—Trail passes over prairies with a rich, heavy grass about eighteen inches high, winding between wooded lakes, to a heavy ravine, with a small and sluggish rivulet in its bottom; sides steep, and laborious for the wagon train......	7	
Prairie sloping towards the western branch of the Chippeway river—a stream, when crossed, about one hundred and forty feet wide, three or four feet deep, with a marked current, and firm bottom; no wood..............................	1¼	
Camp on a small lake, fairly wooded, with luxuriant grass and good water.....	1½	
		9¾

June 27.—Undulating prairie, rich soil, covered with a heavy growth of grass, with small ponds and marshes; woods continue in sight a short distance on the left to Elbow lake, a well wooded lake, of form indicated by its name.............. 7¾

Rolling prairie, with two bad sloughs, to Rabbit river, which is crossed with the wagon with but little difficulty, where it issues from a small lake; it is a small stream, but spreads out from one hundred to three hundred feet, with marshy borders; camp on the small lake, with good grass, wood, and water............ 6 — 13¾

June 28.—Rolling ground, with small ponds and marshes, to a small brook twelve feet wide; 5¼ the Bois des Sioux prairie, a smooth, flat prairie, without knoll or undulation—an immense plain, apparently level, covered with a tall, coarse, dark-colored grass, and unrelieved with the sight of a tree or shrub; firm bottom, but undoubtedly wet in spring; small brook when the train made a noon halt....... 11¾

Same smooth prairie as above to Bois des Sioux river, sometimes soft and miry; camp on river bank; wood and grass good—river-water fair; many catfish caught in the river.. 10 — 27

June 29.—Cross Bois des Sioux river; river 70 feet wide, 4 to 7 feet deep; muddy bottom; steep and miry banks; goods boated over; wagons hauled through, light, with ropes; bad crossing, but passable; smooth, flat prairie, as on the east side of Bois des Sioux, occasionally interrupted with open sloughs to Wild Rice river, and camp with wood, water, and abundant grass................................ ... 11

June 30.—Wild Rice river about 40 feet wide, 5½ feet deep, with muddy and miry bottom and sides, flowing in a canal-like channel, some twenty feet below prairie level; river skirted with elm; river bridged from the steep banks, being too miry to sustain the animals, detaining the train but little more than half a day; small brook, without wood, flowing in a broad channel cut out through the prairie; crossing miry, but made passable for the wagon by strewing the bottom with mown grass.. 2¼

Firm prairie to camp on edge of above small stream; good grass and water; no wood; elk killed by hunter.. 2¼ — 4½

July 1.—Smooth prairie extending to Shayenne river; sand-knolls, ponds, and marshes frequent as the river is approached; the marshes were not miry—firmer bottom; good wagon road; night encampment on bank of river; sufficient grass for train; wood abundant; river-water good; many catfish caught in river....... ... 26½

July 2.—Shayenne river 60 feet wide, 14 feet deep; river had been previously bridged by Red River train, from the poplars and other trees growing on the river, and this bridge we made use of in crossing our wagons; camp on the west bank of the river; water, wood, and grass good...................................... ... ½

July 4.—Prairie undulation, interrupted with marshes and small ponds and occasional small rivulets, to Maple river, about 25 feet wide, 3½ feet deep, firm bottom, and easily passed by the wagons; river tolerably well wooded, and the camp on its edge is furnished with water, wood, and good grass................. ... 16$\frac{4}{10}$

The rich black soil of the valley of this stream is noticeable.

July 5.—To a small stream 30 feet wide, 2 feet deep, clayey bottom, easily crossed by the wagons; prairie high, firm and almost level for some thirteen miles, becoming more rolling and with small ponds in the last seven miles of the march; on the edge of some of the ponds are salt incrustations; camp on the river; water good; grass good; no wood, and the "bois de vache" is used for fuel............ ... 20

July 6.—Country wet and marshy; not a tree in sight; prairie with low ridges and knolls, and great number of ponds and marshes; night's camp by a small pond; no wood, but plenty of "bois de vache;" grass good	...	20
July 7.—Approaching the Shayenne; country as yesterday for some half-dozen miles; bordering on the river the ground is broken with deep coulées and ravines, and to keep away from them the train kept at some distance from the river, encamping by a small marshy pond; no wood; plenty of "bois de vache;" grass good; water tolerable; first buffalo killed to-day	...	15
July 8.—Prairie swelling with ridges; descend to the Shayenne, which flows some 150 to 200 feet below the prairie by a steep hill; camp in the bottom of the river; wood and water good; grass rather poor; the bottom of the Shayenne, some half a mile wide, is often soft and miry, but when crossed by the train, firm and dry	...	13½
July 9.—Cross the Shayenne, 50 feet wide, 3½ feet deep; immediate banks some 10 feet high, and requiring some digging to give passage to the wagons	¾	
Prairie with swelling ridges and occasional marshes to camp, to a slough affording water and grass, no wood; buffalo very abundant	6¼	
		7
July 10.—Prairie swelling into ridges and hills, with a frequency of marshes, ponds, and sloughs; camp at a pretty lake, near Lake Jessie; fairly wooded, with water slightly saline; grass scanty, having been consumed by the buffalo; prairies covered with buffalo	...	10
July 11.—Pass over the high hills resting on the western shore of lake of the encampment and Lake Jessie	1½	
Level prairie, with small ponds and marshes, to a bad slough, 100 yards wide and 3 feet deep, the passage of which caused a good deal of delay, the wagons being drawn through by oxen, by means of long ropes reaching across the slough	4½	
Rolling and hilly, with small marshes and ponds, to camp near some small ponds, surrounded with knolls; water tolerable; grass good; no wood; "bois de vache" plenty; prairies covered with buffalo, running off several horses and mules during the day's march, which were never recovered	4½	
		10½
July 12.—Smooth prairie, generally dry; many small lakes and marshes to be seen on either side.		
Night camp by a marsh, affording tolerable water; grass good; no wood; "bois de vache" for fuel	...	18¼
July 13.—Smooth prairie, abounding in marshy spots. Cross and recross Rivière a Jaques, a small stream, destitute of wood, with a firm bottom, and easy of passage with wagons	14½	
Prairie to camp on the river; water good; grass fair; no wood	5½	
		20
July 14.—Hilly and marshy prairie, with many small ponds; camp by a small lake or pond; water tolerable; grass good; no wood	...	21½
July 15.—Marshy prairie, abounding with ponds; camp near a small pond; water tolerable; sufficient grazing; no wood. At this camp, were joined by a large band of Red River half-breeds. The buffalo have continued plenty, and the "bois de vache" has, without inconvenience, been substituted for wood at the camp-fires	...	2½
July 17.—But little change of country; undulating prairie, with a thin soil, and, excepting in marshy spots, a thin and short grass. Night camp near a small rivulet affording water and grass	...	9½

July 18.—Shayenne river, southern fork; forty feet wide; two feet deep; gravelly bottom, and easily crossed; river flows deep below the prairie, with high banks, and without wood............ 1½

Rolling, hilly prairie; passing Butte de Morale on the right............ 5

Undulating country; pass a long, narrow lake on the right, some four and a half miles long; night camp on an extensive, high knoll, with wood, excellent water, and grass............ 13¼

—— 19¾

July 19.—Prairie with marshy spots, and ponds, and knolls, as usual; seven and three-quarter miles from commencement of march; cross a small brook; camp by a small pond, with water and grass............ ... 16½

July 20.—Rolling prairie, with gravelly, barren knolls, small marshes and ponds; cross Wintering river, a small, sluggish stream, with a muddy bottom, and difficult of passage; water some four feet deep at crossing; nearly motionless, and one hundred feet wide; goods taken over partly in boat; wagons drawn through half loaded; prairies covered with marshes and ponds to camp by a small pond; no 4¼
wood; water tolerable; grass good............ 13½

—— 17¾

July 21.—Reach Mouse river in about six miles' march, and camp on the edge of a coulée making down to the river on its west side. Mouse river is some one hundred and twenty feet wide and quite deep—too deep to ford. It has an intervale one-half to one mile wide; flows deep below the prairie—some two hundred feet below the general prairie level; is well wooded. The immediate banks are muddy and the water is turbid. The valley of Mouse river is cut up with deep coulées or ravines, reaching back from the river on both sides for fifteen or twenty miles. These deep coulées make the travelling very laborious and difficult, and wagons should keep far enough distant from the river to head these coulées, or to cross them where they are shallow and offer little obstruction. In these bottoms are small rivulets making down to Mouse river, and supplying running and cool water. Scattered trees, sufficient for camping, are also to be found in them. Night camp good in grass, water, and wood............ ... 16

July 22.—Skirting the valley of Mouse river, crossing the coulées near their heads. The prairie between the coulées is level and dry. Night encampment near a small, sluggish stream making into Mouse river. Grass and water good; no wood. A party from the second and larger band of Red River half-breeds visit this camp............ ... 16

July 24.—Undulating prairie country, with occasional small marshes and ponds. The route follows immediately under the rolling knolls and hills, making up the high ridge termed the "Grand Coteau," and crosses several coulées at their head. Camp near a small pond with water and grass; no wood............ ... 15¼

July 25.—Route through an undulating and hilly country, approaching the Grand Coteau; knolls stony, and scantily covered with soil or grass. Night camp by a small lake, with grass and water; no wood............ ... 20¼

July 26.—Undulating prairie, with a smooth and good road, rarely broken by marshes or coulées. Night camp by a small pond; good grass; no wood............ ... 20

July 27.—Pass the Grand Coteau; a collection of high, stony, and barren knolls, with great numbers of small ponds lodged between the hills. About eleven miles from the morning camp are two lakes, between which the train passes; the southern and larger of the two lakes is the source of one of the tributaries of White

Earth river. Camp near a small pond, with rather scanty grass; no wood. A large camp of the Assiniboins in the immediate vicinity 15½

July 28.—Country generally rolling and hilly; knolls stony; night encampment on a small tributary of White Earth river, a sluggish rivulet, with scarcely a perceptible current, filled with reeds and rushes. No wood at camp, but obtained from a gulley some eight miles back on the route 19¼

July 29.—Through nearly level country to a small, marshy lake. A wet, marshy ground lies on the left, and about a mile back from the lake, on the route, are two prominent knolls or hills 10

The balance of the day's journey is over an undulating and hilly country, the route for a great part of the way keeping in a valley between the hills. Camp with water and grass; no wood .... 13¼ — 23¼

July 30.—Rolling and hilly country, with stony knolls, throughout the day. Eighteen miles from camp, cross a small tributary of Muddy creek, fifteen feet wide and two feet deep. Scattered trees are to be found in the coulées near this stream. Several dry water-courses were passed in the course of the day, which probably in the time of freshets are occupied by brooks connecting with Muddy creek. Night camp, water and grass; no wood 23½

July 31.—Rolling but not hilly country, with a scarcity of water. Ten miles and three-quarters from camp, water was found in a ravine, in pools. To the left and farther east, the country is more broken, and better watered. Night camp by a small, marshy pond; water poor; grass fair; no wood, and a scarcity of the "bois de vache" 20½

August 1.—Descend to the Missouri and arrive at Fort Union. With the exception of some three or four miles of hilly country near the end of the route, the road is remarkably smooth and easy, passing over high and hard prairie. Camp on the river-bottom below the fort; water from the Missouri—rather muddy; wood hauled for a short distance in carts; grass scanty; animals in the day-time kept on the hills bordering on the river-bottom 16¼

Whole distance from St. Paul to Fort Union 715½

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28. ITINERARY OF THE ROUTE FROM FORT UNION TO FORT BENTON, BY LIEUTENANT DONELSON.

OLYMPIA, WASHINGTON TERRITORY, *February* 18, 1854.

SIR: Agreeably to your request, I have the honor to submit the following itinerary of a route for wagons from Fort Union, on the upper Missouri, to Fort Benton.

Thinking that the object would be accomplished by stating the distances from point to point of those localities where it would be practicable to encamp, and by following this with such observations as seemed called for by the nature of the country, I have adopted that form for the itinerary.

LOCALITIES AND DISTANCES.

No. 1.	6.5	miles from Fort Union. A prairie pond, destitute of wood.
No. 2.	5.84	" Little Muddy river.
No. 3.	15.524	" A small, wooded stream. One or two good camps between Nos. 2 and 3, and 3 and 4.
No. 4.	9.437	" Big Muddy river. Drift-wood.
No. 5.	11.176	" A marsh near the Missouri.

No. 6.	18	miles;	Poplar river. One or more good camps between Nos. 6 and 7.
No. 7.	23.646	"	A point on a small creek not far from its entrance into the Missouri.
No. 8.	15.241	"	Slough, not far from the Missouri.
No. 9.	17.42	"	A point on Milk river. At least one good camp could be found between Nos. 8 and 9.
No. 10.	13.484	"	To a point on Milk river. Several good camps between these points.
No. 11.	17.62	"	To a point on Milk river.
No. 12.	19.66	"	A point on Milk river. Several good camps between Nos. 11 and 12.
No. 13.	17.75	"	Cross Milk river; pursue the trail on the bluffs and descend to that river.
No. 14.	7.68	"	To a prairie lake, destitute of wood.
No. 15.	12.4	"	To second crossing of Milk river.
No. 16.	12	"	To a point on Milk river.
No. 17.	15.5	"	To a point on Milk river. One or more good camps intervening between Nos. 16 and 17.
No. 18.	10.8	"	To a point on Milk river.
No. 19.	20.2	"	" " " "
No. 20.	16	"	" " " "
No. 21.	18	"	Cross Milk river, and encamp on its right bank.
No. 22.	7.46	"	Leave Milk river and encamp on one of its small tributaries.
No. 23.	17.6	"	Encamp on a small stream. Several good camps between Nos. 22 and 23.
No. 24.	6	"	A small stream.
No. 25.	19.36	"	Prairie spring, destitute of wood.
No. 26.	13.85	"	Cross Marias river and encamp on the Teton.
No. 27.	8.7	"	To a good camp on the Teton, or to Fort Benton.

377.508 miles from Fort Union to Fort Benton.

The road is already distinctly marked, as there is an Indian trail from one point to the other. Mr. Lambert's map shows all that is essential concerning the direction, &c., of the road. At those points where there is no wood to be obtained, the reliance must be upon buffalo-chips. Where the road now pursues the valley of the Missouri and that of Milk river, it would be necessary, in very wet weather, for it to follow a rugged course over the adjacent bluffs, as the soil of these valleys is very retentive of moisture, and would probably at such times be impassable. The following streams, which there might be some difficulty in crossing during freshets, are generally low in the travelling season, viz: the Little Muddy, Big Muddy, Poplar, Argalia, Milk river, the Box Alder, Woody river, the Marias, and perhaps the Teton. Timber for bridging or for boats can be found at all of them, except the Big Muddy. Here timber would have to be obtained several miles up or down the Missouri. The grass is good, at nearly all points of the road, from about the middle of May to the middle of August.

I am, sir, very respectfully, your most obedient servant,

A. J. DONELSON,
Second Lieutenant of Engineers.

Governor I. I. Stevens,
Chief of the Northern Pacific Railroad Survey.

29. ITINERARY OF THE ROUTE FROM FORT BENTON TO CADOTTE'S PASS, THE JOCKO RIVER, AND CLARK'S FORK, TO WALLAH-WALLAH, WITH AN ESTIMATE OF THE TIME, LABOR, AND COST OF MAKING A PRACTICABLE WAGON ROAD.

OLYMPIA, WASHINGTON TERRITORY,
January 31, 1854.

SIR: I have the honor to submit a report, written at your request, concerning the opening of a wagon road from Fort Benton, across the Rocky mountains, to Fort Wallah-Wallah. The data upon which the report is based has been obtained, partly from Mr. Lambert's daily topographical sketches and notes, and partly from the notes I made while travelling over the country. As I did not view the country with reference to the construction of a wagon road through it, of course the report is liable to error for that reason. Notwithstanding, I think the estimate is too high; so that the error, if there be any, is on the safe side.

The hypothesis which I have adopted is that, whether there be one or a number of wagons starting from Fort Benton, ten men, each to have a pick, a shovel, and an axe, and each to be capable of an amount of work equivalent to loosening and levelling fifteen cubic yards of common earth per day of ten hours, will be constantly available for work on the road.

The report is in the form of a narrative of the supposed daily progress of the wagons; an accompanying table exhibits the quantity and kind of work, and the time required for its performance.

1st day.—The wagons ascend to the high prairies north of the Missouri, and travel nineteen miles to the Teton, upon which they encamp.

2d day.—They go nineteen miles in a southwesterly direction, and encamp on a prairie lake destitute of wood.

3d day.—They travel fifteen miles to Sun river, and four miles up it, when they go into camp on its left bank.

4th day.—They ascend Sun river four miles; cross it; direct their course to the south of the more northerly of the hills called the "Square Buttes," or "Big Knees," and go fifteen miles to "Bird-tail Rock," on "Crown Butte creek," where they encamp.

5th day.—They direct their course to the southwest; cross Crown Butte creek; cross Beaver creek and four other small streams; go a little to the south of a high hill on the left bank of Dearborn river, and encamp on that river; having travelled sixteen miles. Part of the work would be performed after the wagons halt.

6th and 7th days.—They descend to and cross Dearborn river; travel nearly due southwest; cross that river again; go along the bluffs on its left bank, crossing many ravines and small streams, and encamp at the foot of the dividing ridge, having made fifteen miles in two days. The wagons would arrive at the foot of the dividing ridge in time for the workmen to cut away the timber that day. Heretofore it has been supposed that the inequalities of the ground, where it would be unnecessary to remove obstacles, have been such that the wagons could not move with a greater average speed than two and a half miles per hour. The rate of travel will henceforth be reduced to two miles per hour.

8th and 9th days.—The workmen prepare an oblique ascent and descent of the dividing ridge.

10th and 11th days.—The wagons cross the ridge, proceed down the right bank of the Blackfoot fork and encamp, after making twenty-six miles in two days.

12th day.—They go ten miles, and encamp on the right bank of the same stream.

13th, 14th, and 15th days.—They proceed along the Blackfoot fork; crossing it several times, but continuing mostly on the right bank, and encamp on this side, after travelling thirty-one miles in three days. Before coming to this camp the trail, as it now exists, forks—one branch crossing the Blackfoot and leading to Hell Gate river. This report, and the accompanying estimate, refer only to a road down the Blackfoot fork.

The next eighteen miles would be along the steep sides of hills. Near the end of the eighteen miles is a very severe hill-side, composed mostly of sand and clay, and along which leads a narrow trail. It would be judicious to cross the river before reaching this hill, in order that it might be avoided.

16th and 17th days.—The wagons would not travel, and the laborers would go ahead to work on the road.

18th day.—The wagons would proceed, while the workmen would finish the latter part of this sub-section of the road. Crossing the Blackfoot just prior to arriving at the severe side-hill, of which mention has been made, the wagons halt, after travelling eighteen miles.

19th and 20th days.—The workmen would open the road to Hell Gate prairie, and prepare to recross to the right bank of the stream.

21st day.—The wagons, crossing the Blackfoot and passing through Hell Gate, would go twelve miles to the crossing of Hell Gate river. Here the road should fork—the main branch leading directly on to Wallah-Wallah. A southern branch would make one crossing of Hell Gate river and two of the Bitter Root, and would lead to the Flathead village.

22d day.—Should the latter route be taken, the wagons would cross the Hell Gate and the Bitter Root, and, after making sixteen miles, would encamp on the left of the latter river.

23d day.—They would recross the Bitter Root, and, after travelling fifteen miles, would arrive at the Flathead village. Thus, in twenty-three days, lightly-loaded wagons, drawn by good teams, and accompanied by a working party of ten men, could travel two hundred and thirty-five miles of the route, that being the distance from Fort Benton to the Flathead village. It is assumed that the hours of travelling are from seven to twelve, and from one to five. The road opened would not be a good one, but it would be practicable, and be improved by use and by the work which future travellers might apply to it.

To make a good road—that is, one, the upper line of whose cross-section should be horizontal, and which should have no obstructions except steep grades—would require 200 per cent. more of work. And to make a road which should be good in every particular, would require at least a period of six months.

Wagons leaving the Flathead village for Wallah-Wallah, would return by the same road for 23.25 miles; they would then proceed to the mouth of Hell Gate river, cross it, and go to a point 31.25 miles from the Flathead village, where they would enter the main road from Fort Benton. Two days would be required to come from the Flathead village to this point. We will now resume the main road from Fort Benton, at the first crossing of Hell Gate river, where we left it.

22d day from Fort Benton.—The wagons would go eleven miles to the entrance of the road from the Flathead village, and would encamp; this being a point on the right bank of the Bitter Root, where it would be necessary to leave this river in order to reach the Jocko. The workmen would go ahead and work for ten hours on the road leading to the Jocko.

23d day.—The wagons would not travel, and the workmen would finish that part of the road.

24th day.—The wagons would go seventeen and a half miles and encamp on a fork of the Jocko. The workmen would open the road as far as the crossing of the Flathead river.

25th day.—The wagons go twelve and a quarter miles, and encamp in a valley on the Jocko. The workmen prepare the crossing of the Flathead. The ford of this river is above the mouth of the Jocko; the ferry would be below that point, and wagons would pursue one or the other route, according to the practicability of the ford.

26th day.—The wagons go twelve and a half miles, and encamp on the right bank of the Flathead. The workmen labor for ten hours on the road down that river.

27th day.—The wagons go five miles, and encamp. The workmen continue laboring on the road.

28th day.—The wagons do not travel. The workmen open the road as far as Horse Plain.

29th day.—The wagons go thirteen and three-quarter miles, and encamp on a stream on Kamas prairie. A trail leads along the banks of Clark's fork, or the Flathead river, from the point where this road leaves it; but though I did not see it, I do not think it can be better for a road than to go by Kamas prairie. The workmen this day labor on the road down Clark's fork.

30th day.—The wagons go eleven and a half miles and encamp on Horse Plain. The workmen open the road as far as "Big Rock." This is a steep rocky bluff, which rises to a great height and overhangs the river for about 500 yards. The rock appeared to be limestone, and would, I think, be easily worked. It slopes from the river at an angle of about 60°. It would require about two weeks to make a practicable road around this hill, and would be necessary to blast away a great deal of the rock. Before determining how to proceed here, a reconnaissance ought to be made to determine the best way of avoiding this hill. As far as I can at present say, I think a raft or boat should be made, and the wagons and effects carried by water around the hill.

The wagons should remain at Horse Plain until the road be entirely opened to Thompson's prairie; and this would require seven days, including the preparation for the water carriage, and excluding the work on the road up to Big Rock.

37th day.—The wagons would go nine and a half miles to a prairie and encamp, where there is plenty of wood and water, and but little grass.

38th day.—The wagons go ten and a half miles, and encamp at Thompson's prairie. The workmen labor on the road ahead. As no good spot for an encampment occurs between Thompson's prairie and Lake Pend d'Oreille, the wagons should remain at the former place until within a few days of the completion of the road to the latter.

The Indian trail, as at present existing, leads mostly through dense forests, and over irregular ground, and is, moreover, obstructed by great quantities of fallen timber. These last obstructions would probably have to be removed yearly, as there is reason to believe that the timber, in consequence of the great height of the trees—it may be from winds, and from the forests being occasionally set on fire—is constantly falling. It might be expedient to make an arrangement with the Indians by which the fires could be prevented. I have estimated that it would require fifty days to open the road from Thompson's prairie to Lake Pend d'Oreille.

81st day.—The wagons would go fourteen and a half miles and encamp in the woods, where there is very little grass.

82d day.—They go twelve miles and encamp on Barrier river, with but little for the animals to eat.

83d day.—They go ten and three-quarter miles and encamp in the woods, near some springs, the grass being tolerably good.

84th day.—They go twelve and a quarter miles and encamp near the mouth of a large stream from the east. There is here very little grass, but I was informed that a few miles from the river, and at the foot of the bluffs, was a small stream bordered by a quantity of good grass. This could not be reached but by passing through an almost impenetrable forest.

85th day.—They go thirteen and a quarter miles and encamp on some prairie hills, without water. Here they would remain a day, procuring water by returning a few miles to Clark's fork.

87th day.—They would go twelve and three-quarter miles and encamp on Lake Pend d'Oreille.

94th day.—They would go twelve miles along the east side of the lake and encamp on Pack river.

99th day.—They go fifteen miles and encamp at the foot of the lake.

104th day.—They go twelve and a half miles, cross Clark's fork, and encamp on the left bank of that stream.

111th day.—The wagons go about ten miles and encamp near a pond.

112th day.—They go twenty miles to a small stream and encamp in the woods.

113th day.—They go nineteen and a half miles and encamp on the Cœur d'Alene prairie.

116th day.—They go nineteen and a half miles, cross the Spokane, and encamp on its left bank.

117th day.—The wagons go 12.5 miles and encamp on a small stream in the prairie.

118th day.—They go 12.5 miles and encamp on a small wooded stream.

119th day.—They go 12.7 miles and encamp on another small stream.

121st day.—They go 21.7 miles and encamp on a branch of the Peluse river, after having passed a lake.

123d day.—They go 21.2 miles and encamp on the same stream.

124th day.—They go twelve miles and encamp on the Peluse.

125th day.—They go twelve miles, cross Snake river, and encamp on its left bank.

126th day.—They go 27.5 miles and encamp on the Touchet, a branch of the Wallah-Wallah. There is not a particle of wood or water between Snake river and the Touchet.

127th day.—They go 25.3 miles to Wallah-Wallah. The entire distance from Fort Benton to Wallah-Wallah is about 650 miles.

A more direct road leads from Snake river to the crossing of Clark's fork than the one described above, and a better road might be had from Snake river to Wallah-Wallah by going by the Whitman mission. There would be no difficulty in finding camps along the whole of this route, except between Thomson's prairie and Lake Pend d'Oreille. There are generally Indians with canoes at the streams which would require ferrying. The estimates and statements I have made must be considered as rough approximations; they will, however, serve as a guide in case; and before a further reconnaissance could be made, a plan of operations for the construction of the road should be adopted. While I do not recommend any particular plan of operations, that pursued in the report will, I think, suit the circumstances which may govern, or at any rate may be modified to suit them.

My acknowledgments are due to Mr. Lambert for the use I have made of his sketches; these have guided me in many details which I should not otherwise have recollected.

Respectfully submitted.

A. J. DONELSON,
Second Lieutenant of Engineers.

His Excellency I. I. STEVENS,
Governor of Washington Territory.

Estimate on a road from Fort Benton across the Rocky mountains to Fort Wallah-Wallah.

1st day.	Fort Benton to the Teton......	10 minutes of earth cutting.
2d day.	The Teton to a lake..........	10..do........do.
3d day.	The lake to Sun river.........	20..do........do.
4th day.	Crossing the Sun river........	15..do........do.
	Crossing of a rocky hill........	20..do..to remove stones.
	Crossing of Crown Butte creek,	15..do...of earth cutting.
	Crossing of a fork............	15..do........do.
	2d crossing of Crown Butte creek,	15..do........do.
	3d......do..........do.....	15..do........do.
5th day.	4th.....do..........do.....	15..do........do.
	Crossing of Beaver creek......	15..do........do.
	Crossing of four small streams..	45..do........do.
	Descent to the valley of Dearborn river,	3 hours of earth cutting.
6th and 7th days.	2d descent to the valley of Dearborn river, in which, after descending nearly to the water's edge, you pass about 150 yards along the side of a hill sloping $\frac{3}{1}$,	3 hours and 30 minutes of cutting in earth.

1st crossing of Dearborn river, 40 minutes of earth cutting.
2d crossing of Dearborn river, 40 . . do. . . . . do.
14 crossings of brooks and ravines to the dividing ridge, 15 minutes' work at each, including cutting away timber.
Cutting away timber on the east side of the dividing ridge, 2 hours' work.
8th and 9th days. Ascent and descent of the dividing ridge, 20 hours of earth cutting.
10th and 11th days. Crossing of seven brooks or ravines, including timber cutting for five miles, 2 hours and 30 minutes' work.
13 crossings of streams, side-hill work, and cutting of timber for 21 miles, 2 hours and 30 minutes' work.
3 crossings, and side-hill cutting in 10 miles, 4 hours of earth cutting.
12th day. 3 crossings, and side-hill cutting in 10 miles, 4 hours of earth cutting.
13th, 14th, 15th days. 8 crossings, side-hill and wood cutting for 31 miles, 12 hours' work.
16th, 17th, 18th days. 1 crossing, and side-hill and wood cutting for 18 miles, 26 hours' work.
19th and 20th days. 1 crossing, and side-hill and timber cutting for 12 miles, 20 hours' work.
21st day. Crossing of Hell Gate river, 30 minutes' work.
22d day. Crossing of the Bitter Root river, 30 minutes' work.
23d day. 2d crossing of the Bitter Root river, 30 minutes' work.
2d day from the Flathead village, 2 hours' work at the mouth of Hell Gate river.
22d day from Fort Benton, 10 hours' work on the road leading to the Jocko.
23d, 10 hours' work on the same part of the road.
24th day. 10 hours to open the road to the crossing of the Flathead river.
25th day. 10 hours at crossing of the Flathead.
26th day. 10 hours on the road down the Flathead.
27th day. 10 hours on the road down the Flathead.
28th day. 9 hours in opening the road as far as Horse Plain.
29th day. 10 hours on the road down Clark's fork.
30th day. 10 hours in opening the road as far as "Big Rock."

The next seven days occupied in opening the road from the head of "Big Rock" to Thompson's prairie. After that, 50 days on the road to Lake Pend d'Oreille; 7 days to open the road to Pack river; 5 days to open the road to the foot of the lake; 5 days to open the road to the crossing of Clark's fork; 8 days to open the road to the Cœur d'Alene prairie; 3 days to prepare the road as far as the crossing of the Spokane.

116th day. To prepare the road as far as Camp Washington.
117th day. 8 hours' work.
118th day. 9 hours' work.
119th day. 10 hours' work.
120th day. 10 hours' work.
121st day. 10 hours' work.
122d day. 10 hours' work.
123d day. 10 hours' work.
124th day. 10 hours' work.
126th day. 10 hours' work on a portion of the road which proceeds along the banks of the Touchet.

30. ITINERARY OF THE ROUTE FROM HELL GATE OVER THE CŒUR D'ALENE MOUNTAINS TO THE CŒUR D'ALENE MISSION, AND THENCE TO THE INTERSECTION OF THE ROUTE GIVEN IN H 29.

We left Fort Owen October 2, 1853, to proceed to a good encampment twenty miles down the Bitter Root river, and await the arrival of Governor Stevens. Descended the valley seven miles, crossing to west bank of the river at an easy ford.

October 3.—Crossed three small streams flowing from the mountains into the Bitter Root; the valley on the west bank from two to five miles wide, covered with luxuriant grass. The Bitter Root mountains rise some 3,000 feet on our left, crowned with huge masses of jagged rock. Slopes densely timbered, with larch and pine extending to the river.

October 4.—Governor Stevens arrived from Fort Owen. River makes a bend to the north of west. Encamped on an undulating plain between the St. Mary's and the Bitter Root. The plain affords good pasturage.

October 5.—Proceeded down the valley ten miles, and crossed the St. Mary's in two fords. Visited an encampment of Flatheads of ten lodges, under their chief, Victor. They cultivate wheat, potatoes, and other vegetables, and depend upon the chase for meat. They reside chiefly at Fort Owen in comfortable log cabins.

October 6.—The main train passed to-day, and went into camp two miles below us. Mr. Lander left for the Jocko. Lieutenant Mullan came in at four o'clock, and late in the evening Mr. Tinkham arrived, having crossed the divide between the Blackfoot and the Jocko rivers. It is extraordinary how easy of passage the mountains are in this latitude. A favorite time for the return of the Flathead Indians from the buffalo hunt east of the mountains is between Christmas and New Year's day. The Indians west of the Cœur d'Alene mountains return usually in March.

October 7.—Moved camp at eight o'clock, following down the St. Mary's through an open valley five miles broad, abounding in good grass. The banks of the stream are belted in by timber, yet quite green and scarcely touched by frost.

Making ten miles, the river bends to the south of west, the valley becoming narrow. We crossed a small tributary from the north, and passed over a heavily-timbered country, covered with large masses of volcanic rock. We made thirty-five miles, the greater portion of which led through a fine prairie.

October 8.—Continued down the river through a narrow valley studded with a heavy growth of pine and larch. The mountains are high, and extend their spurs to the river's banks. At one o'clock met a band of Nez Perces and Cœur d'Alene Indians going to join the Flatheads in their fall hunt east of the mountains. Had a talk with them in regard to a proposed council at Fort Benton with the Blackfeet. They were delighted with the prospect of establishing a permanent peace with these Indians, with whom they have been so long at war. After a halt of two and a half hours, proceeded fifteen miles through an open pine forest, and encamped on the north bank of the river. The road has been better this afternoon—not so hilly, and more open. At encampment found Pend d'Oreille Indians; gave them coffee. In return, the women gave us cooked camas root. It is of a sweet, agreeable flavor. Distance thirty-two miles.

October 9.—One mile from camp we crossed the St. Mary's, sixty yards in width, and from two to three feet deep. It is clear and rapid. Crossing spurs of the Bitter Root range at noon, we came upon a clear mountain stream six yards wide. The mountains are densely timbered with pine and larch, averaging two and a half feet through. On the banks of the stream the cotton-wood, willow and button-wood prevail. The line can follow the valley of the river without much difficulty. The river winds much, however, and some sharp deflections may be required. There is an abundance of good building material. The supply of timber, including much fir and spruce, is inexhaustible; and there is a large quantity of stone, well adapted to the construction of sustaining walls.

In the event of the railroad pursuing this route, any quantity of the latter material can easily be brought from the mountains. The ride to-day was rather tedious. We left the valley to get rid of the undergrowth, and took a trail over the side hill, which carried us up and down through woods, occasionally obstructed by fallen timber. Distance to-day nineteen miles.

October 10.—We continued in the valley about ten miles, the road leading through woods. Larch and spruce, and inexhaustible supplies of limestone and marble, were met with. We afterwards found the latter in good quantities all through the mountains. We ascended the dividing ridge, and reached a camp upon a small lake within a mile of its top. Grass here, and water got with difficulty. Good grass a mile from camp on the trail in each direction. The lake to which we were obliged to descend for water is 1,200 feet below the camp. Distance nineteen and a half miles.

October 11.—The rivers from the dividing ridge, following in opposite directions, have their sources in lakes not more than half a mile apart; the general direction of the valley being east and west. We estimated our camp to be 2,000 feet above the eastern base of the mountain, and 2,500 feet above the western base. The lake upon the eastern side was about 1,200 feet below us, and that upon the western side about 700 feet higher. In the morning we were greeted with one of the loveliest days imaginable. The sky was clear, the weather mild and genial, like a morn in summer.

After striking camp, we ascended to the highest point of the ridge, about one and a half mile, where we made halt to enjoy the magnificent view spread open to us, which can hardly be surpassed in any country. Far away to the east the peaks of the Rocky mountains were stretched out to a great length; the Flathead lake, and the valley thence to Blackfoot Pass, were plainly visible. Nearly the entire range of the Cœur d'Alene mountains covered with evergreen forests, with here and there an open summit covered with grass. The numerous valleys intersecting the country for miles around, the courses of the many streams, marked out by the ascending lines of fog, all conduced to render the view of surpassing grandeur. Descending the ridge, we found the road steep, and in eight miles we estimated our elevation less by 3,500 feet than the summit we had just left. This brought us into a valley filled with gigantic cedars, three feet in diameter; many were six feet, and we found one twelve feet through. We found the larch, spruce, and pine-maple in great quantities during the march, the latter giving a pleasing variety to the forest growth.

About four o'clock we encamped upon the bank of the stream which here grows much wider. Made camp about seven miles from the base of the mountain. The day's march seventeen miles.

October 12.—Marched twelve miles; the road much obstructed by fallen timber; circuitous and bad. At half-past three o'clock we halted at a beautiful camp, in a valley where there was an abundance of good grass. Governor Stevens and Antoine proceed at once to the Cœur d'Alene mission, distant eleven miles.

The mission is an enviable location, upon a hill overlooking extensive prairies to the east and west, stretching towards the Cœur d'Alene mountains and the Columbia river. On the eastern prairie is an enclosed field of one hundred acres under cultivation, where were employed thirty or forty Indians—men, women, and children. We observed them ploughing, which they executed skilfully; others were sowing wheat, and others digging potatoes. We saw a funeral ceremony conducted after the Catholic form, and we were struck with the harmonious voices of the Indian choristers, and their solemn observance of the ceremonies. Their church, constructed upon a plan designed by Pére Avali, is of the Roman Doric style of architecture. Pulleys and ropes were the only mechanical aids in its erection. It is of hewn timber and adobe; ninety feet in length, forty in breadth, and sixty in height. The inside is prettily arranged The altar is supported by two massive timbers of pine about four feet in diameter. We were told that, in erecting these pillars, an Indian who was holding one of them became frightened and let it fall, fortunately without injury to any one. The Indians have quite a village of lodges near the mission, and among them half a dozen log huts.

October 13.—The Cœur d'Alenes have already, under the influence and example of their priest, made a fair commencement in agriculture, and will, with timely encouragement from our government, live entirely by cultivation, for which their country is so well adapted. They are well contented, and it is pleasing to observe habits of industry growing upon them. In the barn we saw their operation of threshing. Four boys rode as many mules abreast around in circle, and they were followed by two girls with flails, who were perfectly at home in the business. I observed an Indian woman milking, and was surprised to see her use both hands, something rarely seen among the Indians. We afterwards visited the field. A large fire was burning, and around it sat Indians roasting potatoes at pleasure. There appeared to be great scarcity of proper implements; and in digging potatoes I noticed that many had nothing better than sharpened sticks.

October 14.—Determined to remain here until to-morrow. A Nez Perce, Frank, who with two men arrived yesterday from Wallah-Wallah in three days, and who stopped to exchange horses for flour, says thirty wagons have crossed the military road from Wallah-Wallah to Nisqually. The Cœur d'Alenes, Pend d'Oreilles, Spokanes, and Nez Perces, meet together to fish and hunt. They have an ingenious way of hunting the deer, which is worth relating. A large circle is enclosed, and upon the trees around its circumference are attached pieces of cloth. Then the hunters enter the area and start up the deer. The deer are afraid to pass the cloth, and thus kept within the circle, are easily killed. Last year the Pend d'Oreilles, in one hunt, killed eight hundred; the Cœur d'Alenes more than four hundred. It is said that the Cœur d'Alenes of St. Joseph river have finer lands and larger prairies than those of this mission.

The distance from here to Wallah-Wallah is six days, to Colville four days, and four days to the Pend d'Oreille mission.

On the return of the Indians from the field, Governor Stevens addressed them in kind and encouraging terms.

October 15.—We started at eight o'clock, after having given brother Charles as many lariet ropes for raising the timbers of the church as we could spare. We marched through an extensive prairie bottom four miles in length; leaving the river to the left, we took a course north of west through a wooded, broken country, somewhat obstructed by fallen timber. We camped on a beautiful prairie, with good grass, and here we found nearly one hundred Spokanes, with some three hundred horses, on their way to the hunt. We had already met some forty Indians, Cœur d'Alenes, Nez Perces, and Spokanes, on the road. In the evening the Spokanes held religious (Protestant) services, and we joined them to witness their ceremonies. The majority of the Indians were on their way to meet the Flatheads and other tribes to hunt buffalo on the waters of the Missouri. This is a very strong evidence that the snows will present no insurmountable barrier to communication across the mountains in winter. Many of them make a distance of six hundred miles in midwinter, recrossing the mountains in January, their horses laden with robes and meat, to their homes on the waters of the Columbia. Distance nineteen miles.

October 16.—We started at eight o'clock. The road for the first half of the way through an open, wooded prairie. Then we came into the Cœur d'Alene prairie, a beautiful tract of land containing about six hundred square miles. Trap-rock, projecting above the surface of the ground in spurs, is plentiful as we enter this prairie. We met on the way a half-breed, named Francis Farlay, on his way to St. Mary's with his family. He lives near Colville, just beyond the ferry. They were dressed, and had an air of general respectability.

Soon after leaving camp the Cœur d'Alene lake came in view to the south of us, and eleven miles from camp we struck it near its western extremity. It is a beautiful sheet of water, surrounded by picturesque hills mostly covered with wood. Its shape is irregular, unlike that given it upon the maps. Its waters are received from the Cœur d'Alene river, which runs through it. Below the lake the river is not easily navigable, there being many rapids, and, in numerous instances, it widens greatly and runs sluggishly through a shallow channel. Above the lake, I am informed by the missionaries that it is navigable nearly to the Missouri. Upon the eastern side appeared a range of hills, along the eastern base of which, I think, the road from the mission to Wallah-Wallah passes.

Leaving the lake, we followed the river on its northern bank, passing a camp of Cœur d'Alenes occupied with their trout fisheries. We here witnessed a touching sight, a daughter administering to her dying father. We encamped at a spring, with sparse grass. Had we gone two miles farther we should have found an excellent camp on the river, and the next morning some of our animals were found on the very spot. Towards the latter portion of the march the river runs over a rocky bed of trap. Three miles before reaching camp we struck the south trail. Distance thirty-three miles.

October 17.—Leaving camp, Governor Stevens, Osgood, Antoine, and myself, turned from the trail to visit the falls of the Cœur d'Alene river, while Labatt took the train ahead on the trail to the Spokane house; our course was south of west, five miles to the Cœur d'Alene river and falls. The river here is compressed within a narrow knoll of basaltic rock forty feet high, forming a succession of rapids, which are forty feet in height, presenting a natural barrier to the salmon. There are two principal falls—one of twenty feet, and the other forming two of from ten to twelve feet each; in the latter there is a perpendicular fall of seven or eight feet. For a quarter of a mile over the rough bed of the rapids we estimated the fall at ninety to one hundred feet. One mile below this point we came to the ferry crossed by Saxton. There is a small Indian village here, and the Indians were engaged catching salmon.

From the Cœur d'Alene mission, crossing the river at this point, and on to Fort Wallah-Wallah, there is a very good natural wagon-road; the fathers having transported some of their effects by this route two years since.

Leaving the fishery, we crossed the foot of the great prairie, and over a dividing ridge, with high and steep banks, entered an open oak and pine plain, extending some eight miles to the junction of the Cœur d'Alene and Spokane rivers. In the plain in which the Spokane house is situated were two Spokane villages. Here was formerly a trading-post of the Hudson's Bay Company; but the "house" was abandoned many years since, and but a few scattering stones now mark its foundation. The train we found a mile below the junction across the Spokane, and the Indians indicating a good camp some distance beyond, we moved on eight and a half miles, and reached it at sundown. There was good grass and plenty of water, and we soon made up a large camp-fire.

The Indians report a large party having arrived opposite Colville, also a small party from Wallah-Wallah to Colville. We hear that Jack, Lieutenant Macfeely's guide, passed this place a few days since, and reported that the party had a hard time.

We hear also of another, probably Captain McClellan's party, and the intelligence is confirmed of the passage of the Cascades by thirty wagons. Garry, who was with us two hours, says there is a good trail from the Spokane house to the Yakima country. Made thirty-two miles to-day.

October 18.—Left our camp and the Spokane river at an early hour, and taking a more northerly course six miles over a succession of pine-clad hills, reached a valley from two to five miles broad, affording good grass and some arable land. Contiguous to the site of Yohimakine mission, abandoned six years since by Messrs. Walker and Eels, in consequence of the massacre of Dr. Whitman and family at Wailetpu, made a short halt at noon. Governor Stevens learning from Antoine that it is twenty-eight miles to Colville, where Captain McClellan's party is reported, resolved to push on and reach there to-night. At five and three-quarters he reached Brown's, who informed him that the distance to Colville was eighteen miles. After accepting an offer of some bread and milk, he resumed the road with the same animals, dashing off at full speed, eight or nine miles an hour most of the way, and reached Colville at nine o'clock. Mr. McDonald received him and his party with great hospitality. Captain McClellan, soon over from his camp, supped with him, and chatted until a late hour over the various incidents and success of the enterprise.

The rest of the party followed Governor Stevens on the morning of the 19th, ferried their packs across the stream in a canoe, and descended a broad valley, in which they found settlements of half-breeds and Indians living in comfortable log houses. They cultivate farms and gardens, have herds of cattle and horses grazing in the bottom, indicating much prosperity. This valley extends twenty miles, and will support a large population.

Distance from camp on the Spokane to Colville, sixty miles.

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31. ITINERARY OF THE ROUTE FROM FORT BENTON, BY THE NORTHERN BLACKFOOT TRAIL, TO FORT OWEN.

WASHINGTON, D. C., *July* 31, 1854.

DEAR SIR: I give herewith an itinerary of the route which I travelled from Fort Benton westward to Wallah-Wallah, crossing the Rocky mountains by a pass at the source of Little Blackfoot river, and the Bitter Root mountains by the southern Nez Perces trail:

October 31, 1853.—Ford the Missouri a short distance below Fort Benton, and encamp soon after, hid from the sight of the sun only by the high bluffs bordering the river. At the ford the Missouri is not far from six hundred feet wide, and has a least depth of three feet. Some of the animals, missing the ford, got into deep water, wetting their packs somewhat. Camp on a small stream making into the Missouri, with sufficient grass and water, and a scanty supply of wood 2½

November 1.—Run a nearly parallel course to the Missouri, but kept at some distance from it, to avoid, as far as possible, the deep coulées which cut its banks; road somewhat broken with coulées; but there is little doubt that a practicable wagon-road, with care, could be selected; cold and snowy; neither the river nor the adjacent country could be seen during the day; camp on the Missouri; wood and water good, and grass also, save that it is somewhat snowy.. 18¾

November 2.—During the first half of to-day's journey three brooks are crossed, which cut the country in deep trenches and coulées, and the road is much broken. The latter half of the day's journey is easy, and the country is much less broken. Camp, at night, on the Missouri at some point above the falls. Our route during the day was too distant from the river to obtain a view of the falls, but their roar was distinguished about midday; a cold day, with a morning temperature near zero; soil good during the day; game very plenty; several small droves of elk, a few buffalo, some black-tailed deer and antelope, and at night, near our camp, large numbers of geese, swan, and ducks........ 20½

November 3.—Above the falls the country bordering the Missouri improves in appearance, is less broken with coulées, and the river is not bordered with the steep bluffs as below. The soil and grass are better, and the banks lose their former barren and bare look. A river, the first tributary above Fort Benton on the south side, which will bear the name of ——— river, was crossed about ten miles from the morning camp. It was, at the crossing, some eighty feet wide, and a ford was found with difficulty. In times of high water it would be a troublesome stream to cross, and, as it was, caused us a delay of an hour or two. Camp, at night, on the Missouri, with good wood, water, and grass, save that the latter is partially buried with the snow; cold and snowy during the day; game plenty 16⅔

November 4.—Day's travel wholly on the river border, or near it, and the road is good until, at the end of about fourteen miles, rocky bluffs, almost impassable, crowd upon the river. Beyond this point wagons cannot proceed on their route. We should have crossed to the opposite bank of the river before this, but the river is quite high, filled with floating ice, and dangerous to ford. The whole of the road from Fort Benton to this vicinity is better on the north side of the Missouri. Snowing during the day.................... 17

November 6.—Occupy the day in making a short distance over the rocky bluffs and hills. These hills are partly wooded with pines and other evergreens. At midday ford the Missouri, about three hundred feet wide, three to six feet deep; a chilly, snowy day; the river filled with floating ice, and the water freezing constantly on our clothes and the animals after making the ford. Camp on the Missouri's west bank, at the inlet of a small stream fifty or sixty feet wide, which I suppose to be Dearborn river; water, wood, and grass good.. 6

November 7.—After gaining the camp of November 5th, the more difficult part of the route is passed. The route during the day, keeping as near the Missouri as was practicable, was hilly, but not difficult for pack-animals. The Missouri, in its course coming from the southward, passes out of sight at the close of the day, and thenceforward is not again seen. Encamp on a tributary brook thirty feet wide, with grass, water, and wood—good as usual, and neither enough seen to be troublesome. The country is hilly, partly grassed and partly wooded 11

November 8.—Route follows the general valley on which we encamped last night; ascend it to near its source, keeping on the hills bordering the stream. For the greater part of the day we follow an Indian trail, and the road is generally practicable for wagons, though very hilly and laborious; a good soil, of not much depth; the rock appears generally near the surface; excellent pasturage ground at intervals; camp on the same stream as yesterday; water, wood, and grass as usual..................................... 18½

November 9.—Open, unwooded country, and good road during the whole day. Encamp, at night, within a short distance of the summit of the Little Blackfoot Pass, and by the side of a broad Indian trail, which we strike a mile or two back. A large Pend d'Oreille camp is near by; route during the day perfectly practicable for wagons; good camping grounds in vicinity; Indians have as many as 1,000 horses with them, which are pastured without difficulty.. 16

November 10.—Cross the summit of the Rocky mountains by the Little Blackfoot Pass, above two miles from camp. The divide which separates the water of the Little Blackfoot river from the tributary of the Missouri, finding its source on its eastern side, is an inconsiderable hill, whose eastern ascent can be accomplished with loaded wagons without difficulty, and of which the western descent is as gradual and easy as could be desired. Descend the valley of Little Blackfoot river, of good width, gradual descent, enclosed by half-wooded, half-grassed hills; broad trail, and road good for wagons; good camping grounds abound.. 14¾

November 11.—With the exception of a small portion of the distance, where the trail on the side-hills was too much inclined, the trail has been practicable and easy for wagons. All these cares can be avoided, generally, by taking the bed of the river for a short distance. Valley unwooded for several miles from the stream, excepting what skirts the streams themselves. Near the camp of to-night a large fork comes in from the southward, as large as or larger than the stream which has been followed from the summit, and which is now sixty or eighty feet wide and one to two feet deep. Meet other large bands of Indians with large numbers of horses, all of whom find camping grounds without difficulty.. 17½

November 12.—A good road, practicable for wagons, throughout the day. For fourteen miles the trail keeps to the interval, and then, to avoid a large bend in the river, pursues its same general direction over the grand slopes bordering it. Valley wide and open; good soil, and desirable for settlements. Above seventeen miles from morning camp, cross a tributary, forty feet wide and two feet deep, coming from the southward. Camp on the river, now over one hundred feet wide and three to four feet deep.................. 28½

November 14.—During the march of to-day the valley is narrower, and the trail is not as good as during the 12th. The interval is narrow—quarter to half a mile wide—and steep; half-wooded hills, of about five hundred feet height, enclose it. In several places on the side-hill the trail is too much inclined or steep for wagons, and wagons would be forced to the bed of the river, which is fordable, about one hundred and fifty feet wide and two and a half to three feet deep. The trail crosses the river five times during the day...... 19½

November 15.—Sixteen miles from camp, Blackfoot and Hell Gate rivers unite. Of this distance, about one mile, where the trail passes to the steep side-hill, is impracticable as a wagon road. Wagons would necessarily keep down the interval, fording the river. The ford of Blackfoot river is shallow and good. Many of the intervals during the day have been occupied with an open pine growth; cotton-wood, with occasional exceptions, is found more or less abundantly skirting the river from its source to this point. At the ford of Blackfoot river used by the main train in September, five and a half miles below the junction of Hell Gate and Blackfoot river, my reconnaissance connects with the odometer survey of Mr. Lambert.. 2½

November 16.—Proceed up the St. Mary's valley to Fort Owen, on the route of the odometer survey, and already as such described—the reports of Lieutenant Donelson; a broad and good trail extends up the valley... 27½

Whole distance from Fort Benton to Fort Owen is (miles)........................ 255

This is the estimated distance by this course, and a comparison of its plot with the plotted lines of the odometer survey shows it to be about seven miles in excess. The actual travelled distance would be slightly greater than the length of the courses. A comparison with Lieutenant Mullan's odometer survey from Fort Benton shows that my estimates in descending the valley of Little Blackfoot and Hell Gate rivers were much too small. They are hence correspondingly too great between the summit of the Rocky mountains and Fort Benton.

I am, sir, very respectfully, your most obedient servant,

A. W. TINKHAM.

Governor I. I. STEVENS,
Chief N. P. Railroad Exploration and Survey.

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32. ITINERARY OF THE ROUTE FROM FORT OWEN BY THE JOCKO RIVER, FLATHEAD LAKE, AND MARIAS PASS, TO FORT BENTON.

WASHINGTON CITY, *July*, 1854.

DEAR SIR: I herewith submit an itinerary of the route pursued by myself from Jocko river to Fort Benton, by way of Flathead lake and Marias Pass.

October 10, 1853.—Descend valley of Jocko river to near its mouth, fording river several times; trail wholly on bottom lands, wide and practicable for wagons. 7

Trail forks near the junction of Jocko with Flathead river, one branch descending, and the other ascending, the latter river. In ascending the river, its valley is wide and open—but little wooded in the bottom-lands; the ground is easy for travelling. Ford the river with a depth of about three and a half feet, with a ford of some one hundred and fifty yards, swift current, stony bottom, and low banks. Camp, immediately after fording the river, in the midst of a few tall, scattered pines, with good grass and water, and salmon trout from the river..................... 10½

17½

October 11.—Trail follows the winding of the river, keeping on the western bank. The valley retains its general wide and open character. The wood is mostly confined to the neighboring hills. Road good. Camp on the river bank, with an abundance of drift-wood, pure water, and good grass..	...	18½
October 12.—At the end of two miles the river	2	
Through tolerably smooth grass-land the trail crosses a small summit and touches on the south end of Flathead lake	10	
Follow round the western border of lake, crossing over steep hills. Ground mainly unwooded, but the wooded is approaching near to the trail. Camp on the edge of the lake, with good water, wood and grass	7¾	
		19¾
October 13.—Wooded and rocky hills crowd upon the western border of the lake. The trail winds round these hills through woods of pine, hemlock, fir, spruce, poplar, and is generally narrow, and occasionally steep and rough. Camp in a small meadow on the opening lake, where the grass is good; water and wood abundant, and good as usual	...	12
October 14.—Sometimes trailing through the woods, and then taking to the gravelly beach of the lake, we reach its north bend, and emerge upon an open prairie bottom of good soil. Through this prairie bottom flows Flathead river and some of its tributaries	5¼	
The trail touches the river above the lake. Camp on a brook flowing into Flathead river, with an abundance of wood, good water, and grass	4½	
		9¾
October 15.—Trail on the right bank of the river, but not in sight of it. High, nearly level ground, partly prairie, partly wood land, extends to where Flathead river issues from the mountain ridge on its eastern side. Good road to this point..	18	
Winding on the base of the mountain, the trail is rocky and very rough, but after a short distance the mountains again recede from the river	1½	
The same nearly level upland is renewed. Henceforward, to the prairie east of the Rocky mountains, the trail is absent; always woods. Trail to camp much obstructed by fallen timber. Ford Flathead river, three hundred feet wide, two and a half feet deep; pebbly bottom; banks sixty feet high	1½	
Camp in the woods, without grass	2	
		23
October 16.—Journeyed only to get grass; woods and fallen timber obstructed the trail. Encamped on a small lake, with good grass, wood and water	...	3½
October 17.—Cross Flathead river above its forks, two hundred and fifty feet wide, two and a half feet deep; pebbly bottom; steep banks, sixty feet high. Mountains now close in upon the river and trail, and the valley continues narrow to its source	5¼	
Trail winds up and down the thickly-wooded slopes of the mountain, and is generally very steep and toilsome. The river is occasionally broken with rapids, and then again is still and deep, frequently twelve feet deep. Camp on the hill-side near the river. Grass very scarce	6¾	
		12
October 18.—Trail is easier during the day. Woods of pine, spruce, fir, larch, white birch, and poplar, fill the valley. Occasional small grass spots, nearly stripped at this late season, are met with, but no good camping grounds were found. Camp on one of the small grass spots	...	11½

October 19.—A short distance from yesterday's camp is a very pretty series of cascades of about one hundred and forty feet fall.......... 1

The valley rises rapidly; the brook is several times broken with cascades, and the night camp is over seventeen hundred feet higher than the camp of yesterday. Trail wooded, but not generally difficult. Grass very scarce. Camp near the brook; wood and water good.......... 13¾

—— 14¾

October 20.—The valley suddenly terminates, and we cross the mountain summit in a direct line from camp, a little over four miles. A naked, narrow, rocky ridge closes the valley, and the trail passing it is very narrow, and often only sufficient for the feet of the horse.......... 4¼

Descend precipitously into the valley on the east side, and camp under the dividing ridge, on the edge of a small pond, on whose banks rest the snow-banks of the previous winter. Grass, wood, and water good.......... 2

—— 6¼

At this camp have our first snow.

October 21.—Trail good and easy, descending with a tributary of Marias river, having its source in the small lake on which was yesterday's camp. Seven or eight miles from camp the mountains end, and wood is found only on the borders of streams. The trail ceases here. Prairie extends thence to Fort Benton. Camp on the bank of the tributary of Marias river; grass, water and wood good. Air thick with snow during the day, and several inches of snow on the ground.......... ... 15½

October 22.—Descend Marias river for a short distance, and one of the party becoming too sick to proceed, camp again on the stream; water, wood, and grass good Air very cold; morning temperature nearly as low as zero.......... ... 1½

October 23.—Leave the tributary of Marias river, by which we descended the mountain, and pass over rolling, smooth prairie, fairly gravel, with not a rich, but a tillable soil. Camp on a second tributary of Marias river as large as the one left in the morning; a brook thirty to forty feet wide and one foot deep, fringed with cotton-wood, and liberally supplied with drift-wood. This stream issues from the mountain through a wide and promising opening. Morning temperature nearly at zero; ponds and smooth streams of water frozen over.......... ... 12

October 24.—Continue on the same high, rolling prairie, sometimes stony at the surface; crossing two tributaries of Marias river, eight and thirty feet wide brooks, and at night camp on a large tributary of Marias river, sixty feet or more broad, well wooded with cotton-wood. Deer and bear were near the camp. The day has been raw and chilly; the air so thick with the falling snow as to shut out of sight all objects not very near; our course, in consequence, deviating and uncertain.......... ... 21½

October 25.—Very smooth even prairie throughout the day. After leaving the brook on which we encamped yesterday, no running water was passed; the beds of some small brooks, and of a shallow pond, passed during the day, were mostly dry. Not a tree was to be seen. Encamp at night under a butte, taken to be the "Knee," from its resemblance to that elevation, but actually over forty miles west of it. Here we had good water standing in the bed of a brook; no fuel save a few willow-bushes; the grass was good, but cumbered with the snow. Small game, such as antelope and brown bears, were frequently seen. The Trois Buttes first came into sight to-day.......... ... 23½

October 26.—Very extensive and smooth prairie, without wood, and with a scarcity of water reaching to the Teton, on which we camp. No water seen during the day. The Teton is wooded at intervals with the cotton-wood, and is here 60 to 150 feet wide, and flows in a prairie channel hid from view except in its immediate neighborhood. At our night camp the grass was fine, and wood and water all that was desirable ... 29

October 27.—Descend the Teton; at a distance of ten and a half miles reaching old camp of A. W. Tinkham, of September 10 and 11, on Teton river near the Knee ... 10½

Thence to Fort Benton, in a direct line, is estimated to be ... 33⅓

The same smooth and dry prairie, already noticed, lies between the Teton and Missouri rivers.

The whole length of this reconnaissance, from Lieutenant Donelson's last camp on Jocko river to Fort Benton, is (miles) ... 295¼

This distance is simply estimated, and at its different points will sometimes be found too large and sometimes too small. As a whole, it appears to be in excess about ten miles. The courses are also more or less erroneous; much of the trail, where passing through the woods and fallen timber, in being very serpentine, and changing its direction 100° a rod or two, without opportunity for giving a general course; while on the prairie the air was often so thick with snow that it was impossible to retain a direct course.

Very respectfully, your obedient servant, A. W. TINKHAM.

Governor I. I. STEVENS,

Chief of Northern Pacific Railroad Exploration and Survey, Washington, D. C.

33. ITINERARY OF THE ROUTE FROM FORT OWEN, BY THE SOUTHERN NEZ PERCES TRAIL, TO WALLAH-WALLAH.

From Fort Owen westward to Wallah-Wallah the journey was interrupted with many detentions and delays; a portion of it was made with snow-shoes and packs, when our whole day's march sometimes amounted to but two or three miles; and hence, in giving the features of this route, it will not generally be desirable to notice separately the journey of each day, as heretofore.

Cantonment Stevens, the winter quarters of Lieutenant Mullan, is on the St. Mary's river, fourteen miles above Fort Owen. The southern Nez Perces trail leaves the main trail, which ascends the St. Mary's valley at the forks of the river, twenty-six miles above Cantonment Stevens, and traces the southwest fork to near its source. To the fork the valley of the St. Mary's retains its open and prepossessing character, with good grazing and much good soil; and a practicable passage for wagons can be obtained with occasional divergings from the present trail ... 40

November 21.—The southwest fork of the St. Mary's is, a short distance above its union with the main stream, above eighty feet wide, three feet deep, with a bottom of large round stones of granite or gneiss. The trail is narrow, (generally a single horse-trail;) is mostly on the strips of bottom-land, crossing and recrossing the stream at frequent intervals, and is not practicable for wagons. The valley is narrow, closed in by high wooded hills; and the trail leaves it near its end, above where we entered it—a distance of ... 24

In this distance snow had appeared, and finally was about eight inches deep; and the streams were half frozen. At this season no *good* camping grounds can be found; the grass is very scanty, and the valley generally wooded, so as to be very troublesome crossing.

November 23.—After leaving the valley of the southwest fork of St. Mary's river, the trail passes over a high and hilly ridge to the Kooskooskia. During the passage snow covered this summit ridge, after a while as much as three feet deep. The trail is steep and laborious, wholly impracticable for wagons, but would not have been difficult if not covered with snow. As it was, we were three days making our way through the snow. The opportunities for camping all appear insufficient except for very small parties; and it is probably usual to make the passage from the St. Mary's fork to the Kooskooskia in one day, where, on the bottom of the river, is a small open and level spot used as a camping ground, with water and wood abundant as usual, but not much grass. There was no snow.

November 26.—The trail does not follow the valley of the Kooskooskia, but, as usual, the steep slopes of its western sides. Some of these side-hills are grassed, and one of them afforded us a tolerable camping ground. The Kooskooskia is a small stream, where crossed, sixty to eighty feet broad, with a pebbly bottom, and flows in a deep, gorge-like valley, wooded with pine, fir, spruce, cedar, hemlock, &c. The trail ascends very rapidly for some seven circles, gaining a greater elevation of near eight hundred feet above the sea. Five and a half miles from the river the snow became so deep that it was impossible to force the animals farther; and from that point, with a portion of my little party, I proceeded on foot........ ... 6½

December 7.—Over high wooded ridges to some small stream making to the southwest, there may be here a tolerable camping place in summer for a small trail party. The whole country was covered with a deep snow when we crossed the stream.. ... 10

December 10.—Continuing over the high wooded ridges, on this day, we reached a small stream running north, near whose source is a wide open spot nearly level, apparently covered with grass, and which I judge to be in summer an excellent camping ground for a large train. Wood and water are always abundant. The only trouble is to find sufficient grass.................................... ... 14

December 11.—The usual character of the country separates this little spot from the valley of a small stream, affording another excellent camping ground for parties of any size. Here is a small brook, at first twenty feet wide, but soon increasing its size, the valley of which for some five or six miles continues unwooded, with an interval about a quarter of a mile wide, covered with abundant and good grass. The hill-sides afford enough of scattered trees for camping purposes. This is the best spot for camping between the St. Mary's valley and the Nez Perces country. It was the first spot free of snow we saw after leaving the Kooskooskia valley.... ... 9

December 13.—After following the valley just described, the trail again passes to the hills, wooded and covered with snow, as usual. The trail is not, however, difficult for a pack-trail. Near the source of a small stream, probably a tributary of the one reached December 11, there is another large open spot, apparently well grassed, with a rivulet making down through its centre. This is apparently a suitable camping spot for a large party, and is nearly three miles long.............. ... 15

December 14.—A hilly and tiresome trail connects the above spot with a small stream flowing in a deep narrow valley, into which the trail descends only to have again renewed the labor of toiling up its opposite slopes. A small and inconvenient opportunity will be found for camping here................................ ...

December 16.—Some ten miles from this stream we pass a high summit, whose broad white top, conspicuous amid the surrounding mass of dark wooded mountains, had been seen near a week before. I suppose it to be the highest of the trail between the Kooskooskia and the Nez Perces country. The trail to this point ascends rapidly, and though not difficult, is steep and tiresome. On the summit is a broad open spot which may afford grass, but probably not water. The snow

was very deep there when we crossed it. A few miles from this open hill-top is a small stream, which I supposed would in summer afford a good camping ground. There was apparently here sufficient grass	...	14
December 17.—The mountains, with their woods and snow, end with this day, and we emerge upon the open, high plateau of the Nez Perces country, through which flow the different tributaries of the Clearwater river. A suitable camping ground is found just as the trail issues from the woods, where, on the borders of a small stream, are water, wood, and grass	...	13
Passing over a farther interval of high open country, the trail descends to the bottom-land of a large tributary of Clearwater river, a stream some one hundred and twenty feet wide and two feet deep	...	7
December 24.—On this stream are the Nez Perces. But few lodges were near the mountains at this time. A broad trail runs down the valley, but after following it for some six miles we left the river-bottom, and by a steep road up the high hills enclosing the river, gained the high plateau above it. A high open plateau country, generally with a good soil and well grassed, extends thence to Mr. William Craig's, whose house is on the Lapwai, about fifteen miles from the river; a good camping ground is to be found on the bottom-land of a small stream, furnishing wood, water, and grass. The Lapwai river also affords good camping ground	...	43
December 27.—From Mr. Craig's to Snake river is about fifteen miles. The trail leaves the Lapwai at the end of four miles, and for most of the distance, to Snake river, passes over high ground. The country is such between the Lapwai and Wallah-Wallah, that, excepting the crossing of Snake river, it is probably practicable to use wagons in transportation, excepting that crossing, the only difficulty being in ascending and descending the steep slopes of the deep valleys in which all the tributaries of Snake river flow. Snake river was about 450 feet wide when we crossed it, deep, and with a strong current, and is evidently at times much wider and deeper than this. It is wholly destitute of wood. Indians are generally to be found near by, who, for a small payment, ferry over the passengers and goods, and, if necessary, assist in getting the horses across. The trail follows down the bottom of Snake river for but about seven miles, and then passes to the valley of a small tributary brook. Here is a fair camping ground. The stream is tolerably well fringed with wood, and the grass is sufficient	...	23
December 28.—Trail passes up the intervale of a small stream, lined with cotton-wood and willows	5¼	
By a steep ascent gained the high plains, on which it continues to a small stream, name not known	8	
The valley of this stream affords a good road; the brook is lined with cotton-wood and willows, and all the essentials of camping are found here	10½	
Passing over a high hill separating the two streams, we gained the valley of the Tchannon river, where was a considerable encampment of Nez Perces. This stream is well supplied with cotton-wood. The grazing, owing to the large number of Indian horses, was very poor	3	
	——	26¾
December 29.—Trail crosses the Tchannon, and ascends by a steep hill to the high plains	1½	
High, smooth, grand plains continue to the Touchet river	10	
	——	11½

December 30.—The Touchet, where we strike it, is from 30 to 60 feet wide, and about 3 feet deep, pouring out its waters with remarkable rapidity. It soon in-

creases in size, and is not always fordable. A good trail follows the valley. The stream is well supplied with wood, and good grass and water for camping are readily found	32½	
Leaving the Touchet, with an easy ascent the trail passes again to the plains; the soil becomes poor and sandy, the grass gives place to the artemisia, and, approaching Wallah-Wallah, the country is a sandy, wild-sage desert. In this interval is neither wood, water, nor sufficient grass	19½	
		52
Total distance from Fort Owen to Fort Wallah-Wallah		340¾

This is the sum of the estimated courses. It is probably no greater, and is perhaps a little less, than the actually travelled distance. The course plotted and compared with the odometer survey appears to be about ten miles in excess. Most of the mountain reconnaissance was conducted during thick, snowy weather, with snow-shoes and heavy packs, and under circumstances that rendered it impossible to obtain an accurate survey.

I am, sir, very respectfully, your obedient servant,

A. W. TINKHAM.

Governor I. I. STEVENS,
Chief N. P. Railroad Exploration and Survey,
Washington, D. C.

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34. ITINERARY OF CAPTAIN MC'CLELLAN'S ROUTE; PREPARED BY J. F. MINTER.

OLYMPIA, WASHINGTON TERRITORY,
February 25, 1854.

SIR: I have the honor to submit the following itinerary of the route pursued by the party under your command, in an exploration of the Cascade mountains, during the months of July, August, September, October, and November, 1853.

		Miles.
July 18, 1853.—From Fort Vancouver to camp Wahwaikee; wagon road through fir, with dense underbrush; road good; crossed a running creek	1¾	
Camp on a small plain, grass and wood good; water half a mile distant	½	
		2¼
July 21.—To camp Kolsas, road same as on the 18th; crossed two small prairies with good grass; crossed small stream	4¼	
Camped on a large prairie; grass indifferent; water for animals quarter of a mile from camp	¾	
		5
July 22.—To camp Sim-Sik; Indian trail passing for one mile through Kolsas prairie, thence through a dense fir forest, with much underbrush and fallen timber; country flat; much labor to clear the trail from here to Chequoss; no water during the march; camped in a small prairie near a little brook; soil poor, grass good; seven hours and a half from camp to camp	...	6
July 23.—To camp Mesache. Country rougher than heretofore. Crossed two boggy creeks, and two with fine crossings; much fallen timber and brush; timber as before; camped on a small stream fifteen feet wide; grass in small openings of the forest; twelve hours from camp to camp	...	6½
July 24.—To camp Mankas. Country becoming still rougher; obstructions on the trail very great, but rather less than yesterday; crossed a fine stream; bottom thickly overgrown; soil good	3	

Crossed a rivulet	2½	
Encamped on a small prairie; good grass; water inconvenient; camp to camp eight and a half hours	½	
		6
July 25.—To camp Yahkohtl. Country becoming rougher; obstructions on the trail, principally from dead timber; descended a very steep hill, with a small stream at the foot, a branch of the Yahkohtl	3½	
Crossed a rough divide, and descended a long and steep hill to Yahkohtl river	1¼	
Passed over a rolling country, with open woods on the higher portion; thick brush in the bottoms; camped on the edge of Yahkohtl prairie; soil and grass good; good water in running stream close to camp	5	
		9¾
July 31.—To camp Chalacha. Country rolling; some short, steep hills; dense underbrush and timber; many fallen trees; crossed five streams	2¾	
Crossed another, but smaller stream	2	
Travelled up the prairie and encamped. Good water and grass	¾	
		5½
August 1.—To camp Spilyeh. Country rolling and heavily timbered with fir, oak, white maple, and cedar; crossed small rivulet in a deep ravine	1	
Crossed four small plains covered with fern to the height of the head of a mounted man; commenced descent into the valley of Cathlapoot'l	3	
This descent is long, steep and dangerous; the trail winding down the narrow crest of a ridge, with a precipitous descent on each side. Here we lost a mule, killed by falling over the steep side-slope. At the foot of the descent a small spring branch, sandy bottom, of half a mile, and cross Cathlapoot'l	1¼	
Pass over rough and thickly timbered country; cross Spilyeh creek	2¼	
Travel over a similar country, and camp in a plain one mile long; grass and water good	2½	
		10
August 2.—To camp Lakas. Country level and open, but much heavy fallen timber; cross small stream	2⅝	
Pass through small plain, covered with fern; descend steep hill and touch Cathlapoot'l	2¼	
Follow valley of the stream, over stony beach; current rapid; bottom of large stones	1¼	
Follow left bank of the stream, and encamp in the woods; no grass	¼	
		6½
August 3.—To camp Noompt-nah-mie. Crossed the river a few hundred yards above camp. During the march crossed one fine stream, coming in on the right bank, three miles from camp; afterwards three spring branches; trail keeps near the river; heavy brush; in one spot a fine grove; country barren; passed over a tract of lava three quarters of a mile in length; crossed the Noompt-nah-mie near its mouth, and encamped at the crossing; no grass; crossing difficult in low water; impossible in high water	...	8
August 4.—To camp Wininepat. Crossed a high, narrow ridge, with steep ascent and descent; small brook at its foot on north side; pass through open woods of fir, cedar, maple, and alder; crossed another rivulet, and then crossed the Cathlapoot'l; followed the stony beach half a mile, and recrossed	2½	
The trail passes through a small opening, and then a new trail was cut through the thick brush and fallen timber for about two miles, to avoid a very deep crossing;		

crossed two bad sloughs; encamped on the bank of the river; no grass at camp; crossed the animals to a small island where there was a scanty supply..........	4	
		6½
August 5.—To camp Wahamis; passed through open pine woods, and crossed the Cathlapoot'l..	½	
Leave the river and ascend five terraces, and reach the base of a high ridge....	3¼	
Ascend the ridge by a winding trail, so steep as to be barely practicable.......	1	
Descend on a gradual slope and over rolling country through open pine woods; passing one opening with good grass and water..........................	1¼	
Thence through similar country to camp in a marshy valley, with good grass and water	¾	
		6¾
August 6.—To camp Yawakamis; over a high, rolling country, through a small growth of fir and pitch-pine, to a small prairie with good grass and a small creek; considerable fallen timber thus far	5¼	
Over a high ridge to a spring branch, with no grass.........................	½	
Cross a high spur, and pass through burned and fallen timber, to a bold creek..	2	
Through open woods to another creek	¼	
Over a ridge with level top, timber burned, to a ravine with a small spring branch; on this branch, a short distance above the trail, is a prairie with good grass	½	
Thence through burned woods, much obstructed by fallen timber, to camp in a prairie with good grass and water; this prairie is boggy in the wet season.......	¾	
		9¼
August 8.—To camp Chequoss, through level country to a creek	½	
Over a rolling country, lava district, to a small creek in a ravine; a little grass near by	1¾	
Ascend a high ridge, by a long and gradual ascent, to a small pond with good grass..	2¼	
Through a succession of small and connected valleys, with good grass, spruce timber and no underbrush, to camp in a valley; grass good; drinking-water in an Indian well; water for animals in ponds	1¼	
		5¾
Total distance from Vancouver to Chequoss..................................	...	93¾
August 11.—To camp Hool-hool-se; over broken country covered with lava and a thin growth of pine and fir, with thick underbrush, to a small lake surrounded by good grass and horse-mint	¾	
Over similar country somewhat obstructed by fallen timber, to a bold creek....	4	
To a small prairie with good grass, but no water in the dry season	2½	
Through a beautiful open wood of excellent yellow pine, coarse, long grass, and light soil, underlaid by lava, to camp on a fine creek; grass good................	4¾	
		12
August 12.—To camp on Tahk prairie; over a country like the last of yesterday's march, to a large stream—the Nikepum..................................	3	
Ascend a high plateau—travel over its broken surface, rocky in places, and covered with large timber, to a small creek..................................	2¼	
To another creek, no grass near it	½	
To another, no grass upon it..	1½	
Thence to camp on a large prairie, with good grass, water, and soil	1¼	
		8½

August 13.—To second camp on Tahk prairie; trail skirts the eastern edge of the prairie, which is perfectly level, covered with good grass, and has good soil; the timber skirting it is of yellow pine, free from underbrush; lake near north end of prairie; camped on a stream rising from this lake	...	5½
August 14.—Through open woods to crossing of last creek	¾	
Over a rolling country, covered with open pine woods, to the Wa-wak-che river, which runs in a very deep and narrow valley; descent precipitous; no grass in the valley; lava is occasionally met with in the distance	4¼	
Make a long and gradual ascent from the valley; pass over a broken country, which is covered with open woods of yellow pine and oak, to a point where there are water and grass, a short distance to left of trail	4¾	
To camp in a narrow valley, with a small creek and good grass	3	
		12¾
August 15.—Over a country like that of yesterday's march, to two springs with good grass	1½	
To a small spring branch, with good grass	5¼	
To camp, in the woods, with a small rivulet and tolerable grass	2½	
		9¼
August 16.—To camp Simkwe; through country like that of yesterday, only more broken	5	
Over high rolling ridges, bare of timber, except here and there a scrub-oak; the ground covered with lava, in fragments, to the Sahpenis; the valley of this stream is deep and narrow where we reached it; descent gradual	3	
Over a slightly undulating and open plain to the Simkwe creek	1	
Followed the course of the creek and camped upon it, with good grass	5	
		14
August 17.—To camp Atahnam, over the level bottom of Simkwe valley	4¾	
Cross a high, bare, stony ridge, and camp on the Atahnam, with good water and indifferent grass; no water on the trail between the camps	2¾	
		7½
August 20.—To camp Wenass; over a high rolling country, bare of trees, and covered with thin bunch-grass, to Kwai-wy-chess creek	8	
Over similar country, more rocky in places, to Nahchess river; descent into its valley steep	3¾	
Cross the wide and level valley of the Nahchess, pass the rolling dividing ridge, and camp on the Wenass, with good grass and water—wood not plenty	4¼	
		16
Good grazing in the valley for a large number of animals.		
August 23.—To camp near Nahchess river; followed valley of Wenass; grass good; yellow pine begins	8	
Leave valley of Wenass, and ascend dividing ridge; ascent steep at two points; divide alternately covered with open pine woods and bare lava	6	
Descend from summit through open woods; trail quite steep in places. Encamped in a small ravine, with good water and grass	3	
		17
August 24.—Descended into valley of Nahchess. Trail steep in places	¾	
Followed valley of Nahchess; trail crosses the river eight times; sometimes passes in the water for short distances; crossings bad. Where the stream flows through the narrowest cañons, the trail crosses the mountain spurs, and is very		

difficult, from the steepness of the slopes, the loose stones, and fallen timber. Camp in a small prairie with good grass	15¼	
		16
August 25.—To camp on the summit of divide. The trail crosses the river four times; generally keeps to the mountain sides. It is very bad, being frequently steep, rocky, and much obstructed by fallen timber and brush. Before reaching the divide, it passes three or four small marshy prairies, with good grass. On the divide are four or five prairies of a similar nature and larger size. Dense growth of small spruce near the summit. Camp in small marshy prairie, with good water and grass. Small pond in the prairie	...	15
August 27.—Returned to near camp of 25th	...	15
August 28.—Camped near where we first reached Nahchess on the 24th	...	16
August 29.—To Depot camp on Wenass. Descended valley of Nahchess. Trail generally in the valley; sometimes passes over high and short spurs; crossed the river twice. Trail generally good; rocky in two or three places; good grass	8	
Left the valley, and crossed a long high spur, passing by a small lake. Opposite this spur the river runs through a very narrow and deep cañon. Descend to the valley again by a rocky ravine	1¼	
Followed the valley, which gradually widens out; trail rocky, and constantly ascending and descending from one low terrace to another; where we re-entered the valley, a few small scrub-oaks; reached the trail where main party crossed on the 20th	7	
Followed the old trail to Depot camp on the Wenass	2½	
		18¾
September 3.—To camp at Ketetas. Trail passes over a high and rolling country, generally covered with angular fragments of lava. The ascent from the Wenass valley is quite steep. No trees on or near the trail. Descend through a narrow ravine, by a gradual slope, into the valley of a small stream; no grass; stream in a cañon; a few small willows and cotton-woods border it	6½	
Ascend from the cañon through a lateral narrow cañon, much obstructed at first by fallen fragments of basalt. Pass over a high, rolling country, and descend into the valley of Ketetas by a long ravine; no water in this ravine; then follows the valley of the Yakima; crosses a small and pretty stream just before reaching camp at the crossing, with good grass and wood. Abundant grazing for many animals	7¾	
		14¼
September 4.—To camp Tsai-it. Crossed the river at camp; crossed three small rivulets soon after; pass along the level valley, with good bunch-grass all the distance, and reach the Tehnam, a small but fine stream	8¾	
Ascend a low plateau by a ravine with a gentle slope; pass over its undulating surface; enter open pine woods about two miles beyond the Tehnam, and again come in sight of the Yakima, near camp. Camp on a small prairie, which extends to the river. Grass not good	8½	
		17¼
September 5.—To camp Ksit-kas. Trail passes through open pine woods, with a few small prairies; cross the river twice, also several rivulets, and the Samahma. Valley level and broad. Camp in a large prairie, with good grass and water	...	16
September 6.—To camp Aiyutas, on the divide; keep to the valley, through woods with very thick underbrush; cross one steep spur, descend into river bottom, and cross the river	2¾	

Cross the divide between Kahchess and the Yahinse, and re-enter the valley of Yahinse. The trail steep in places, and very much obstructed by fallen timber and brush. Cross the Yahinse	8½	
Follow the valley; pass by the lower end of Lake Kitchelus, ascend gradually for a few miles, and then the trail passes over the steepest mountain we encountered, follows its summit, and descends to the little plain called Aiyutas. Grass indifferent at camp; none on the trail from camp to camp; water from a small spring	7¾	
	——	19
September 8.—Returned to camp of 6th	...	19
September 9.—To camp Kahchess; trail as on the 6th to the first crossing of the river. Follow valley of Kahchess; pass through pine woods with dense underbrush; cross the Kahchess twice by steep ascents and descents. Encamp in a small, boggy prairie, near Lake Kahchess. Grass not very good	...	5½
September 10.—To camp Kleallum; turned back on same trail as far as first crossing of Kahchess	2¾	
Follow the heavily timbered but level valley; brush thick	2¼	
Thence over a mountain ridge heavily timbered, crossing three spring branches to valley of Samahma. Descent into this valley very long and steep	4	
Follow the valley to foot of Kleallum; open pine woods and bunch-grass; cross Samahma where it issues from the lake	1¾	
	——	11¼
September 11.—To camp Tsai-ih. Descend the high and undulating valley of the Samahma to its mouth, crossing the stream twice; reach our trail of the 5th	5½	
Follow our old trail to camp	5	
	——	10½
September 12.—To Depot camp at Ketetas; return by our trail of the 4th	...	17½
September 19.—To camp Nahnum. Move to the northern edge of Ketetas valley; trail good, sometimes stony; grass good in places; crossed the Nahnum twice. Encamped where it issues from the hills; grass not very good	...	8¼
September 20.—To camp Skilkantin. Pass over divide between Yakima and Columbia, crossing the Nahnum at camp; the ascent generally gradual, but very long; cross two spring branches; trail stony in places; summit of divide flat; timber small and dense near the summit, open and large below; descent towards the Columbia very steep; during the latter part of the march good bunch-grass on the mountain side, but no timber. Camp in a deep and narrow valley; good water and bunch-grass; wood scarce	...	16¼
September 21.—To camp on Pisquouse. Crossed Skilkantin creek half a mile below camp; follow the rapidly-descending valley, and cross a steep spur, and descend into valley of Columbia; followed valley of Columbia	1	
Crossed one creek four miles below Pisquouse; trail good; crossed Pisquouse half a mile above its mouth. Camped on it just above crossing; grass scanty	7	
	——	8
September 23.—Follow Columbia valley; trail keeps to a level terrace	3	
Crosses a difficult and rocky spur of hornblende rock and granite. Beyond it a small stream; then a level terrace, broken occasionally by less difficult spurs than the last; crosses a second spur much like the first, and reach the En-ti-at-kwu	8	
Follow a high, sandy terrace, and encamp in a thin grove of pitch-pines. Ground stony; grass abundant a short distance from camp	1½	
	——	12½

September 24.—Keep the Columbia valley. The trail passes through the grove of pines; ground much obstructed by fragments of granite	½	
Crosses a very dangerous spur; the trail passes over low rocks; is very narrow and tortuous; high precipice on the right. Two mules here fell over and were instantly killed; two others were severely injured	1	
Pass over a lower terrace, at first stony, then smooth and unbroken. Camp in a thin grove of pines; grass good. The whole day occupied in making this distance of two miles	½	
	——	2
September 25.—The trail follows the river valley, over level ground; crosses a dangerous mountain side, impassable in high water. The trail is here very narrow, and passes over a mass of angular stones, at a very steep inclination; enters the mouth of a ravine, down which runs a small stream	½	
Leaves the river valley; ascends the ravine with a steep inclination; reaches a high ascending valley at right-angles with the river; follows this valley and enters that of Lake Chelann, into which it descends by a gradual inclination	3¾	
Skirts the lake and crosses at its source the stream which issues from it	2½	
Passes over a high, rolling country, and descends a very steep hill into the Columbia valley. This descent is not rocky. Crosses a small stream. Camp in a small sandy "pocket;" grass good; wood very scarce	3½	
	——	14
September 26.—Pass over the level bottom in which we camped. Ascend, in deep sand, without vegetation, to a very high plateau	¾	
Followed this plateau, covered with good bunch-grass; pass one broad, deep, and rocky ravine; keep the prolongation of the same plateau, and descend by a steep, sandy slope to the Columbia bottom	2¾	
Follow the Columbia bottom on the Methow river; last mile among rocks	8¼	
Good trail over a low terrace; crossed small spring branch	1¾	
Trail as before. Camped near an isolated point of rocks; grass good; wood scarce	2½	
	——	16
September 27.—To camp on Okinakane river. Trail passes over the high and rolling valley; crosses one deep and dry ravine; thence touches the Okinakane near its mouth; follows valley of that river; crosses by a bad ford. Camp a quarter of a mile above the crossing; grass and wood very scarce	...	6¼
September 28.—Cross the Okinakane at yesterday's crossing; trail passes over very high, sandy hills, destitute of timber, and covered with bunch-grass; descends into valley of a small creek	7¼	
Ascend a high and steep hill	¾	
Pass over very high hills, covered with open pine woods; follow a high and narrow valley. Camp on a small spring branch in the pine woods; grass plenty, but coarse and indifferent	4	
	——	12
September 29.—To camp on the Twitsp. Trail continued in same valley; crossed two small spring branches; passed over a high spur and descended into the valley of Methow	7¾	
Followed the broad valley of the stream, keeping on a terrace about thirty feet above the water, and covered with bunch-grass; passed one small creek; crossed the main stream	2¾	
Kept in the main valley, and crossed the Twitsp; trail good	1¼	

Turned up the valley of the Twitsp, which is very narrow at its mouth; passed over a long and steep side-slope, over a high plateau; descended into the river-bottom; crossed the stream four times, and camped in wide part of the valley, which is often a mere ravine	6¾	
	—	18½
September 30.—To second camp on the Twitsp; followed the valley, crossing one small brook; the trail occasionally passes along the mountain side, the valley being narrow; cross the Twitsp a short distance above mouth of Nai-hai-ul-ix-on	4¾	
Left main valley; crossed a very steep and rocky spur, and entered the difficult ravine of the Nai-hai-ul-ix-on; the trail here is very rocky, and much obstructed by bushes and fallen timber; crossed the stream by a steep descent and ascent	2¼	
Here left the animals, it being impossible for them to proceed farther; proceeded on foot, until the barometer proved the ravine impracticable for a railway; turned back on our trail, and encamped one mile above camp of yesterday; good grass and wood	7	
	—	14
October 1.—On the old trail to the main camp below Forks Methow	...	10
October 2.—Followed our former trail to where we entered the valley on the 29th September	2¾	
Kept the river valley, crossing two small rivulets; during this time passed from high to low terraces; the low ground often boggy	2½	
Left the valley, and travelled over a quite high and rolling country, destitute of timber, but with good bunch-grass; descended into the valley of Methow, and crossed the stream	2	
Passed over a high spur, and down into the river bottom; crossed in the same way other spurs, some quite high and steep; camped in a small pocket; good wood and grass	5¼	
	—	12½
October 3.—To camp of September 26th and 27th; the trail leads over a mountain spur, and crosses the river	¾	
Pass under a high hill, and over a steep hill-side, and cross a bold stream	2	
Leaves the valley, and passes over a very high and rolling country, destitute of timber, until it re-enters the Methow valley	4½	
Keeps the valley, passing over some rough spurs, and reaches Columbia	2¼	
Follows our old trail to camp of September 26th and 27th	4¼	
	—	13¾
October 4.—To camp on Okinakane river; followed our trail of September 30th as far as the crossing; then continued a quarter of a mile on the right bank, instead of coming to the left	...	4½
October 5.—Followed the level Okinakane valley; crossed the river	2½	
Left river valley, and followed an ascending lateral valley; came opposite to a small lake on the right of the trail	3¼	
Passed another lake one mile long, with rough, high banks on left of trail	1	
Reached a small spring branch, with good water	2¼	
Passed summit of lateral valley, and descended by a trail, quite steep in places, to the Okinakane valley; camped in the bottom; grass and wood good	3¼	
	—	12¼

October 6.—Followed the Okinakane valley; crossed the river; crossed a bold creek coming in from the west; crossed another fine creek on the same side; camped on the river bank; grass good; wood not plenty. The trail generally

good to-day, though sometimes passing over spurs and high rolling plateaux; grass generally good in the valley; no large timber	...	5¼
October 7.—Ascend a high plateau; follow it for some distance; descend and cross a fine creek	3¾	
Keep the level, open bottom, and cross the river	2	
Follow the lower terrace; cross there small creeks, and camp on river bank; grass good; wood indifferent; good travelling to-day	10	
		15¾
October 8.—Follow the valley, passing under a high, steep mountain; reach Indian village at the forks	2	
Crossed the east fork	¼	
Follow the right bank, changing from terrace to terrace; trail always good; camp on river bank, crossing a small stream at camp; grass fair and wood good	12¾	
		15
October 9.—Pass over a broad, level plateau to a rocky spur	3½	
From the spur, by passing through a marsh, again follow a level terrace; pass under a high, gravelly hill, and cross the river	3¾	
Follow the stony bed and recross, passing between high, bluff points of rock	1¼	
Pass over a very rough and high country; camp on the edge of a marshy shore, among the rocks; grass good and wood abundant	3	
		11½
October 10.—To Great lake and back to camp of yesterday; there being no valley, the trail passes sometimes through marshes, sometimes over mountains, high rolling terraces, &c.; never very rocky; open timber on the mountains	...	26
October 11.—Turned back on trail of 9th to first crossing of river	4¼	
Instead of crossing the second time, kept on left bank, passing over rolling country	5¼	
Left main valley, and followed an elevated lateral valley; re-entered the main valley; passed some small lakes in the lateral valley, and crossed a creek	4¼	
Followed down the main valley; camped on lake shore; grass good; wood indifferent; trail very good to-day	1¾	
		15½
October 12.—To camp Kah-loo-sheep; followed the edge of the lake; trail generally very good	3¾	
Crossed a high ridge into the valley of a small stream; ascend this valley to near camp, then pass over very rolling and terraced country; recross the same stream, and camp upon it; grass and wood good; trail has ascended gradually to a very high elevation	5¾	
		9½
October 13.—Pass over a high, rolling country; patches of larch timber here and there; cross a summit and a small stream; descend into the valley of the Siyakan	7¼	
Ascend a high and steep hill; pass along a high plateau; cross two small branches; descend into the valley of the Siyakan, and cross it near its mouth	4½	
Follow the lower terrace of the Nehoialpitkwu, passing through open woods; cross that stream, and camp on the left bank; grass and wood good; with the exception of a few steep hills, the travelling to-day was excellent	1¼	
		13
October 14.—Trail generally keeps the valley; occasionally passes over high spurs and plateaux; woods open; cross the river four times: cross two small branches on the right bank and four on the left; camp on the river bank, with good grass; trail good	...	17½

October 15.—Trail and country like those of yesterday—not quite so good; crossed the river twice; camp on a high bank; grass pretty good 15¼

October 16.—The valley being very narrow and thickly wooded to-day, the trail is worse. It passes over several high and stony spurs; follows the bed of the stream in places; crosses the river four times; camp in a low bottom surrounded by mountains; grass poor; trail bad 17¼

October 17.—Camp opposite Colville. Trail passes over one high, steep ridge, then over a high, rolling, and timbered country, to the Columbia; cross the Nehoialpitkwu once; trail better than yesterday; scarcely any grass to be found 11¼

October 18.—Crossed the Columbia with all our animals and baggage in perfect safety; camped on a level plateau half a mile above the crossing; good grass and wood 1

October 22.—To camp Schlowskan. Left Columbia valley behind Fort Colville; ascended the valley of Mill creek; followed that valley; crossed the main creek twice, by deep fords; crossed and camped upon a large branch; camp in the open woods, with fair grass; trail excellent....................................... ... 14½

October 23.—To camp Kitsemawhep. Keep to the valley; the trail crosses some low spurs, and is in places rather boggy; on the whole, it is good. Crossed one very bad branch about a mile before reaching camp; repaired an old bridge for the pack-animals; camped on the main stream, which is narrow and swimming; crossed the packs in a canoe; "swam" the animals........................... ... 13½

October 24.—To camp Loichin. Heavy snow-storm during the last night and this day; kept the open, boggy valley for one and a half mile, then entered the open pine woods, and passed over rolling country; camped on the edge of a small open valley; animals suffered for want of grass, it being covered with snow; no water; used melted snow 8¼

October 25.—To Chunakane Mission. Passed through a rolling country, covered with open pines, for nine miles; then entered the open and level valley of the Chunakane, and followed it down to the Old Mission; trail excellent. Animals here picked a little grass. Crossed several small streams to-day 14¾

October 26.—To camp Helse-de-lite. Passed through rolling country, covered with open pine woods; crossed the Spokane river by a good but winding ford.... 5

Ascended from the valley by a ravine, and came out upon the Spokane plain; first two miles through open pine—the rest over an open, rolling country; passed one small lake, on left of trail; camp in a deep and narrow valley, with good grass on the plateau 6

——— 11

October 30.—To Sul-ilt-kwu. Ascended from the valley of our camp to the plateau. Pass over a high rolling country, with occasional ravines and narrow strips of pine timber. Cross a very deep and boggy stream 5½

Travel over perfectly open and slightly rolling country; pass over a rocky ridge near camp; camp on a small running stream, with good grass and poor wood.... 2½

——— 8

November 1.—To camp Sın-sic-hon-iltn. Passing over an undulating country, covered with good grass, and broken by long, swelling ridges. In places the ground is covered with lava; and many small, circular ponds occur. Pass by a long lake.. 2½

Country as before, without the ponds; camp on a small stream; good grass in the vicinity; good fire-wood; trail very excellent............................ 6¾

——— 9¼

November 2.—To camp St-kahp. Travelled over smooth country, between long, high, and smooth hills; passed by a small lake; crossed a small running stream, and a short stretch of rocky, broken country	4½	
Again over gently undulating country, and into a broad valley, in which are several small lakes	3½	
Over a very broken country, winding around among projecting masses of basalt, to a long lake to right of trail	1¾	
Trail passes near margin of the lake; crosses the stream issuing from it; follows the rocky cañon in which the stream runs, and over a broken country to the stream on which we encamped. Water and grass good; wood abundant for camping purposes	9½	
	—	19¼
November 3.—To camp Che-ra-kwa. Trail passes over a very barren and broken country; much outcropping lava and fragments of lava. Passes by one small pond	6	
Over a gently undulating country, broken by gently swelling ridges, and covered with bunch-grass and sage bushes; no timber whatever; descend into the deep valley of the Cherakwa	6½	
Passes down this valley, which is bounded by very steep walls of basalt. The trail occasionally passes over rocky points. Crossed the stream, and camped in a small pocket, with good grass on the hills. Dead bushes the only fuel	5	
	—	17½
November 4.—To camp on Lewis's fork, or Snake river. A short distance below camp left the valley of Cherakwa; crossed a high, rocky spur, and re-entered the valley. Soon left it and followed a high plateau, occasionally crossing rocky spurs; crossed Cherakwa; in the Peluse valley; crossed Peluse	5	
Left valley of Peluse, here wide and barren, and destitute of timber. Passed over a very high and broken country, mostly covered with lava. Grass occasionally on the hill-sides. Descended into valley of Peluse by a very steep and long descent	9	
Followed valley of Peluse; crossed that stream, which is fringed with small timber, and has but little grass. Arrived at the Snake river a short distance below the mouth of Peluse. The animals swam over; the packs, &c., carried over in canoes; everything crossed in safety. Camped on the barren bank of the river. Good bunch-grass on the hills; used drift-wood for fuel; no other to be had	2¾	
	—	16¾
November 5.—To camp on the Touchet. Ascended the high plateau bordering Snake river; pass over a country made up of a mass of rounded hills; finally arrived in a broad, smooth valley, without water; thence into the fine valley of the Touchet. Camped upon the stream; trail capital; excellent grass, soil, and wood; no water from camp to camp	...	21
November 6.—To camp at Whitman's Mission. Crossed the Touchet near camp; passed over a country similar to that of yesterday; came into the valley of the "Dry Fork" of Wallah-Wallah; soil and grass excellent in the valley; no running water	9¾	
Followed this valley	3¾	
Left the valley, and passed over country similar to that between Touchet and Dry fork; cross one small spring branch; reach the valley of Wallah-Wallah river	4¾	

Cross obliquely the valley of the Wallah-Wallah, crossing three small creeks; camp near Whitman's Old Mission; grass good.............................. 1

19¼

November 7.—Follow valley of Wallah-Wallah on right bank, crossing the branch on which we encamped a few hundred yards after starting. Trail good, and generally level to crossing of Too-she.. 9¾

Trail now passes over sand-hills; often leaves the valley for a time, and is generally heavy; little or no grass in the valley; cross the Wallah-Wallah twice; camped two miles from Fort Wallah-Wallah; grass very poor; wood scarce.... 8¾

18½

November 8.—Followed valley of Wallah-Wallah to the fort; trail in deep sand; no grass or timber; cross the stream twice.................................. 2

On leaving the fort crossed the Wallah-Wallah; passed over a high and rocky spur; followed a cañon, and by a steep, rocky ascent, gained the valley of the Columbia. Followed a level sandy terrace, with but a few occasional bushes. Camped on the river bank, with but little wood and grass; plenty of sage....... 10

12

November 9.—Followed the sandy river-bottom. Trail sometimes passes over at the base of rocky spurs, which run out to the river......................... 6

Leave the river-bottom and ascend a high, sandy and barren plateau. Travel over this behind the ridge bordering the river................................ 8

Descend into the river-bottom, which is here very sandy, and destitute of grass. Cross the Umatilla at its mouth; crossing good............................... 1½

Continue on the river-bottom and camp. The animals here managed to pick up a few blades of grass. No timber; a single piece of drift-wood had to serve for fuel for the whole party... ½

16

November 10.—Trail follows the river-bottom, and generally keeping close to the bank; on one occasion, leaving it for about six miles to cut off a bend. There is no grass in this day's march. The whole country is a desert of loose sand, with a few sage bushes. A high wind, blowing in our faces, caused great suffering to the command from the clouds of sand. Camped near river bank, in a cluster of low bushes. Little or no fuel of any kind. Sage and cuckle burrs were the principal food of the animals.. ... 14¾

November 11.—Country like that of yesterday, and sand equally disagreeable. Crossed Willow creek (Hokespan).. 11

Ascended from its valley by a steep slope; passed over a high plateau, and soon descended again into the river-bottom, which was like that of yesterday. Camp in the sand-hills; a little very poor grass on a low flat; a few small whortleberries. 4

15

November 12.—Travelled among sand-hills.................................. 6

Passed along the base of high basaltic cliffs; trail sometimes rocky, at others sandy; then ascended a high, narrow plateau, on which is bunch-grass. Descended into a small ravine, and camped on the river bank. Grass on the hills. A little drift-wood supplied us with fuel.. 3¾

9¾

November 13.—Crossed a steep, rocky point, and then followed among the sand-hills, occasionally passing over or at the base of basaltic spurs and cliffs......... 8

Pass a very bad, rocky spur, and then over the stony beach................. 1

Among sand-hills again.. 1

Rose to a high, narrow plateau, with bunch-grass; descended into the narrow and deep ravine of the Mahah, (John Day's river,) and crossed; bad descent into the river	3¼	
Crossed very high sand-hills, and re-entered Columbia bottom, which is of the usual sandy nature. Camped in a thicket of willows. Grass on the hill-sides; willows for fuel	1¾	
		15
November 14.—Trail passes over sandy bottom; then crosses a very bad, rocky point, some three-quarters of a mile in length. The trail is here narrow and somewhat dangerous in places	1½	
Descended into river-bottom, which we kept as far as the Des Chutes, passing over two rocky points not quite so bad as the first. Struck the emigrant road about three miles before reaching the Des Chutes. Crossed the Des Chutes, ferrying the baggage; crossing bad	6¼	
Ascended from the Des Chutes valley by a long and steep ascent; followed the undulating plateau; then by a still steeper ascent gained a very high level; followed this upper plateau, and descended, by a very long and gradual slope, into the valley of Olney's creek. No timber whatever on these plateaux, but good bunch-grass. Camped on the creek; good water and grass, but no wood. Used the "bois de vache" for fuel	3¼	
		11
November 15.—Followed down the valley and crossed the creek	½	
Left the creek and followed a smooth, ascending ravine; crossed a summit and reached the valley of another branch of Olney's creek; descended valley of the main creek to the Columbia	5¾	
Followed Columbia valley to Fort Dalles; trail excellent. Camped near a small spring, with good bunch-grass on the hills	3¼	
		9½
Total distance travelled northward and back to Fort Dalles		1,051¼

I will here add, that the above itinerary only embraces the tract of country passed over by the main party and detached parties under your immediate command.

I am, sir, very respectfully, your obedient servant,

J. F. MINTER,
Assistant Engineer.

Capt. G. B. McCLELLAN,
Commanding Expedition, &c.

I.

GENERAL CLIMATOLOGY.

35. REPORT OF LIEUTENANT S. MOWRY, U. S. A., TO CAPTAIN GEORGE B. MC'CLELLAN, CORPS OF ENGINEERS, OF THE METEOROLOGY OF THE CASCADES.

OLYMPIA, WASHINGTON TERRITORY,
February 10, 1854.

SIR: In compliance with your instructions, I have the honor to submit the following report of the meteorological observations, taken under my directions, for the western division of the North

Pacific Railroad Exploring Expedition; and also, herewith, the observations tabulated according to the form established by the Smithsonian Institution.

The meteorological observations commenced July 2d, and continued, with an interruption of a few days only, from July 17th to July 21st, until November, embracing a period of nearly five months, and the entire country from Fort Vancouver, Washington Territory, to Fort Colville, Washington Territory, north of the Columbia, and the return through the same distance south of the Columbia, including the country east and west of the Cascade range, and at one point approaching within two hundred miles of the Rocky mountains. At only two points were the observations continued for a sufficient time to form a correct estimate of the climate at the season of the year in which they were taken—at the camp on the Wenass river, and in the valley of the Yakima.

The thermometer for the month of July indicates a temperature ranging—

From 44° to 66° at sunrise.
From 65 to 74 at 9 a. m.
From 78 to 94 at 3 p. m.
From 69 to 83 at 9 p. m.

Weather clear and pleasant; general direction of wind northwest; no rain.

For the month of August—

From 48° to 64° at sunrise.
From 58 to 76 at 9 a. m.
From 71 to 88 at 3 p. m.
From 52 to 79 at 9 p. m.

Weather generally fair; general direction of wind south and southwest; rain on 7th, 8th, and 9th instant.

For the month of September—

From 42° to 58° at sunrise.
From 51 to 73 at 9 a. m.
From 58 to 84 at 3 p. m.
From 50 to 73 at 9 p. m.

Weather unsettled; wind, general direction south and west; rain fell on 1st, 2d, 13th, 15th, 16th, 23d and 24th instant.

For the month of October—

From 10° to 59° at sunrise.
From 47 to 67 at 9 a. m.
From 51 to 83 at 3 p. m.
From 41 to 70 at 9 p. m.

Weather cloudy; wind south and southwest; rain fell on the 14th, 15th, 16th, 17th, and 30th instant; snow fell on the night of the 23d and morning of 24th.

It will be observed, from the statement and from the tables, that the disproportion between the temperature at sunrise and mid-day is very great—a peculiarity of the climate noted in Greenhow's History of the Northwest Coast, and I believe by other authorities. The rise in the thermometer from sunrise to 11 o'clock was in many instances noted to be as high as 15°, and during the hottest days experienced late in August, at sunrise the thermometer stood as low as 40°.

I have no recollection of a single day on which a fire was uncomfortable during the time just preceding and succeeding sunrise.

The heat was not generally oppressive, except in the sun, throughout the march. Rain fell on the occasions noted above.

At Chequoss, on the summit of the Cascade range, August 9th, there was a severe storm, lasting but a few moments, however, of mingled hail and rain, accompanied by a strong gale from the southwest.

During this day the thermometer indicated a temperature below the freezing-point, and ice formed to the thickness of half an inch. At the same time and place strawberries were growing in great luxuriance and abundance—an anomaly agreeable in itself, and worthy of mention.

The Indians, who resort to this place annually for berries, informed me that the weather was usually as we found it there; and they were well provided with blankets for protection against the cold. From the same source I gathered the information that the snow falls here as early as November, and during the winter covered the trees.

On leaving the low prairie lands back of Vancouver, and gradually penetrating the range of mountains, the atmosphere, clear below, became smoky. This appearance continued throughout the country in the vicinity of the mountains. It is believed to be caused chiefly by the immense fires which, from time to time, are kindled in the forests by the Indians, and which lay waste large sections of country. For scores of miles we marched through a country entirely devastated by this element.

The change of temperature from a high point to a low one as we ascended the mountains, its remaining at nearly a fixed point while traversing the summit, and the gradual increase as we descended into the valleys, will be noticed by referring to the tables.

The expedition remained in camp in the valley of the Wenass river two weeks. At this point the thermometer ranges higher than at any other. The highest temperature indicated was on the 24th of August, at 3 p. m., 100° in the shade; but during the last week in August the average temperature at meridian was above 90°—at sunrise it reached 50°. The valley of the Wenass is almost one thousand feet above the sea-level. An extract from my meteorological journal for one day describes the appearance of the cloudy and the general character of the weather throughout the month.

August 26.—Sun rose clear and brilliant; no dew; air hot and dry at 8 a. m.; no breeze until 9 a. m. From 9 a. m. light cirrus and cirro-stratus clouds visible, rising in southern and western horizon, gradually becoming cumulus p. m. Sky one-third cloudy at 4. p. m. The last three days would have been suffocating by heat had it not been for a gentle breeze, and clouds at intervals obscuring the sun. The thermometer near a cool running stream, and in the shade, ranges from 90° to 100°. Strong breeze from northwest at 9 p. m. Comet visible from 6½ to 7.38 p. m.; brilliant near the horizon, and emitting luminous particles from the nucleus, or from the tail near the nucleus. That there should be no possibility of mistake about this last phenomenon, I called others to observe it, and for several minutes luminous particles were distinctly seen thrown out, like sparks from heated iron under the hammer, taking no regular course, and expiring a short distance from the nucleus or tail.

From the camp on the Wenass river the expedition moved to the valley of the Yakima, about twenty miles to the north and east, where we remained in camp about three weeks. The temperature here was much lower than at Wenass. From the 1st to the 19th of September, the thermometer at noon seldom indicated a higher temperature than 70° to 80°. Some rain fell early in the month; the weather was threatening, and the barometer unsettled in its indications for several days preceding and succeeding the 10th. I am informed by the Indians, and also by the reverend father of the Yakima mission, that the snow in the winter falls in these valleys to a depth of from six to ten feet, rendering them wholly uninhabitable, except near the mouth of the Yakima and the approaches to the Columbia river.

The expedition reached Fort Okinakane September 27th, and here again for a few days the heat was intense. The temperature of the water of the Columbia was above 52°, and of the Okinakane much higher.

Proceeding up the Methow river, and attaining a latitude above 48°, and a point elevated some two thousand feet above the sea, we again, only three days after leaving Okinakane, found a temperature below freezing at sunrise, and scarcely reaching 50° at meridian.

While ascending the Okinakane river, early in October, the temperature, after the first chill of morning had passed, was much the most agreeable we experienced, although it was late in the season, and the latitude nearly 49°. This continued, with slight exceptions, during our descent of the valley of Colville river, and during the first of our stay at Fort Colville. The mornings, however, were, with scarcely an exception, cold and raw; ice formed in the buckets, and heavy frosts were visible.

The lowest temperature indicated by the thermometer, during the march, was on the 23d of October—8° half an hour before sunrise, 10° at sunrise. During the preceding day the thermometer read below 32°. The frost on that day was the heaviest I have ever seen; it remained distinctly visible until nearly noon. Snow fell on the night of the 23d and morning of the 24th to the depth of six inches, the only snow observed throughout the march. It was succeeded by a rain and thaw, which removed every vestige of it in a few days. The valley back of Colville is well settled, and the inhabitants assured me that it was unusual to have snow so early.

Severe frost attended us from this time, with few exceptions, until our arrival at the Cascades of the Columbia. After leaving Wallah-Wallah we had one or two showers of rain, but none of long continuance until the expedition reached the Cascades. I learned from the Indians, and old residents of the upper portion of the Territory, that but little rain falls above latitude 46°.

Thunder and lightning, a phenomenon of rare occurrence in this climate, were observed only two or three times. It is worthy of remark that the Indians assert thunder and lightning to have been introduced by the whites.

Aurora Borealis was faintly observed on two occasions—on September 1st, and during the night of the 27th of the same month. I extract from my journal the notes made on the latter date.

September 27, 1853.—Aurora Borealis was observed, commencing about 7 p. m., in the north horizon. The phenomenon first exhibited was that of rays of light, commonly called "needles," shooting up, distances varying from 8° to 15°, alternately brightening and darkening. This appearance gradually extended towards the east, until it was exhibited throughout the horizon from north to north by east. The light gradually diminished in brightness, and when nearly blended with the general color of the horizon, (purple gray) it took the form of an arch, with a rise of about 7° and span of 40°. This arch gradually dilated in length and height until it became almost 90° in length and from 15° to 18° high.

During the earlier part of the time the arch was visible, the horizon enclosed within it was perfectly dark, and the aurora increased in brilliancy, until it became beautifully distinct and finely marked.

As the arch gradually assumed its greatest size, the same phenomenon first observed became again visible, and within the arch strong flashes of light, some needle-like in shape, others broader and less fine, but gradually converging to a point until they reached their greatest altitude; then falling until they became nearly indistinct, and again reviving in their original brilliancy. This commenced in the eastern point of the arch, or was just observed there, and extended itself over the whole enclosed horizon. Outside of the arch, at its northern extremity, bright flashes of light were thrown up, resembling in every respect those observed within.

During the continuance of this arch the "needles" of light did not attain a greater height than 12°. About 11 p. m. the arch had disappeared, and given place to an appearance of similar nature to the first observed, but on a much grander and more beautiful scale. Narrow streams of light, exceedingly brilliant, shot up from the horizon to the zenith, distinctly marked and separated from each other by dark shadows intervening.

This light had a waving, tremulous motion; the shadows, moving with the light, gave an appearance of panoramic views passing from left to right. This last phenomenon was one of exquisite beauty. The moving of the light, its alternate darkening and again becoming brilliant, and the flashes, shooting far up into the heavens, gave a phantasmic character to the scenes entirely inappreciable to one not a witness of it.

Observations were made on shooting stars, meteors, and other phenomena of like nature. The results are given below, taken from my journal:

August 7, 1853.—Observed several shooting stars: one passing from the northern sky, about 45° above the horizon, in a westerly direction; one passing over an arc of 15° in a direction diagonal to the first. A brilliant meteor, from just below the zenith, passed over about 25° in a direction north of west; others not distinctly observed.

August 9.—Ten or twelve meteors of large size were observed, leaving distinct and brilliant trains behind them; most of these meteors originated in the vicinity of the North star. The course of the largest and most luminous was nearly parallel to the horizon, occasionally one inclining slightly towards the zenith. Four or five brilliant meteors passed from northern to eastern sky, over arcs varying from 10° to 35°. Four bright stars passed from the southern sky about 45° to the horizon. Two small stars passed reciprocally from west to north and from north to west, their traces crossing each other about the middle of each; the arc described being about 25° in length, respectively, beginning and ending near the North star. Some three or more shooting stars were observed passing generally from the northern to the western sky, over arcs ranging from 10° to 40°. Hours of observation from 9 to 12 p. m.

August 10.—Seven large brilliant meteors observed passing from northern sky, near the North star, to western sky, nearly parallel to the horizon. Four of nearly same size and appearance passed from the eastern sky to the horizon. Several small shooting stars, forming a cluster, passed from northern to eastern sky in a line nearly parallel to the horizon; at the same moment a meteor passed from the north to the western sky.

August 26, 7 *p. m.*—A very brilliant and beautiful meteor was observed. It appeared almost six inches in diameter, and was first seen in the eastern sky, about 40° below the zenith. It moved in a northerly direction, and gradually descended towards the horizon, with a slow regular motion, occupying several seconds in its course, passing over an arc of about 20°, and disappearing about 25° above the horizon. Three distinct colors were displayed in its progress—yellow, purple or reddish, and light-blue. The blue tint became perceptible just below the disappearance of the meteor, and seemed to separate from it, forming a light cloud which slightly expanded before disappearing.

Between 7 and 8 p. m., several shooting stars were noticed—general direction across the zenith from west to east, and *vice versa*. These stars were quite brilliant, but small, and left distinct trains of luminous matter. At 8.45 p. m., a brilliant meteor passed in a northeast direction, describing an arc of 20°, beginning about 40° above the horizon and descending; at 9 p. m., one from zenith, course south about 10°; at 10 p. m., one from zenith, 15° in length to the east; at 12 p. m., one from zenith towards east, arc of 50° described, course perpendicular to the horizon. This star was very brilliant. Of the star noticed between 7 and 8 p. m. as leaving the zenith, two of the most marked described arcs of 30° to 35° in length.

September 22.—A brilliant meteor was seen about 9 p. m. in the southern sky. It exploded with a noise resembling thunder. Not having seen it myself, I am unable to describe it more minutely.

The general facts with regard to the climate, deduced from these observations, are: first, the exceeding dryness of the atmosphere, the hygrometer indicating often a difference of 20°, and seldom less than 10°, between the wet and dry bulb; second, great scarcity of rain during the late spring, summer, and early autumn months, and, above the latitute of 46°, an almost entire absence of rain throughout the year; third, a great disproportion between the temperature of the nights and days, and a tendency to freezing, even in the summer months, during the hours just preceding dawn.

The climate is, by the united testimony of the inhabitants, a healthy one, but east of the mountains certainly not favorable to agriculture. In this, however, nature, which does not present incongruities, has adapted climate to country. Where there is no soil for the labor of the agriculturist, the necessity for a favorable climate is not apparent.

As the observations of this portion of the expedition, together with the others, are to be placed in the hands of a competent person, and a general report on the meteorology of the Territory prepared for them, I have confined myself to the above statement of facts.

The instruments used by the expedition were two English barometers, Green's hygrometers and thermometers. The rain-gauge was broken soon after leaving Fort Vancouver, and from that time no measurement of rain was taken. The expedition is indebted to John B. Preston, Esq., late surveyor general of Oregon Territory, for two French barometers. They were, however, of little value, soon broken, and the observations made with them do not appear in the tables. The last English barometer was broken near Fort Okinakane, and in place of it an aneroid was used. From my experience with the latter, I have small faith in it as a field instrument. Its observations have been tabulated to October 26th, in order to connect with those of the main expedition from the east. From its movements, however, I should be afraid to vouch for their value. In the general observations of the expedition I have perfect confidence. My assistant, J. D. Biles, is a faithful and accurate observer, and I am indebted to him for much valuable assistance. The principal observations were taken by him under my directions.

A series of observations were made at Vancouver, by my direction, with the standard barometer, beginning July 19th and ending November. The observer was a man already noticed by the Smithsonian Institution for correct and accurate observation, and I believe the series taken by him to be reliable.

The thermometer, for the month of July, at Vancouver, indicates a temperature ranging—

From 60° to 68° at sunrise.
From 67 to 78 at 9 a. m.
From 80 to 90 at 3 p. m.
From 71 to 82 at 9 p. m.

Weather, fair and pleasant; general direction of wind, north and northwest; no rain.

For the month of August—

From 50° to 60° at sunrise.
From 60 to 70 at 8 a. m.
From 74 to 85 at 3 p. m.
From 54 to 71 at 9 p. m.

Weather, clear generally; general direction of wind, northwest; rain fell on the 7th, 8th, and 9th instant.

For the month of September—

From 46° to 58° at sunrise.
From 52 to 69 at 9 a. m.
From 60 to 79 at 3 p. m.
From 52 to 70 at 9 p. m.

Weather, cloudy; general direction of wind, west; rain on the 13th, 14th, 15th, 17th, 20th, and 21st instant.

For the month of October—

From 33° to 57° at sunrise.
From 49 to 66 at 9 a. m.
From 51 to 83 at 3 p. m.
From 42 to 69 at 9 p. m.

Weather, cloudy; general direction of wind, north and northwest; rain fell on 5th, 11th, 13th, 15th, 21st, 24th, 25th, 27th, 30th, and 31st instant.

For the month of November—

From 32° to 53° at sunrise.
From 36 to 52 at 9 a. m.
From 39 to 59 at 3 p. m.
From 34 to 56 at 9 p. m.

Weather, cloudy; general direction of wind, south and southeast; rain fell on 13th, 14th, 17th, 18th, 19th, 20th, 21st, 22d, 23d, 24th, 25th, and 26th instant.

These observations present no striking phenomena; and for particulars I beg leave to refer to the tables, not only in this case, but throughout the expedition. The remarks daily are full and accurate, and will be a sufficient guide to any one interested in the subject.

In connexion with the tables, I have the honor to submit a list of the camps, with the temperature of the soil at the surface, and also one foot below the surface; and, in addition, a list of the streams crossed by the expedition in its march, with the temperatures of the streams at the time of crossing.

The expedition is indebted to the Rev. Mr. Atkinson, of Oregon City, for a series of meteorological observations from 1849 to 1853; to Dr. Steele, of the same place, also for observations; to Mr. Moore, of Lynn City, for a copy of thermometrical observations, taken early in the history of Oregon, after the white settlements were made, and originally published in the "Oregon Spectator," the first newspaper in Oregon Territory. These observations will accompany the tables, and are of great value as affording means of comparisons of the climate during different years.

I take great pleasure in acknowledging the personal courtesy shown me by the above-named gentlemen, and also by Amory Holbrook, Esq., who rendered me valuable assistance in my search after old and forgotten observations.

I am, Captain, very respectfully, your obedient servant,

SYLVESTER MOWRY,
Second Lieut. 3d Artillery, in Charge of Meteorological Observations.

Capt. George B. McClellan,
Corps of Engineers, Chief of Exploring Expedition, &c., &c.

Olympia, Washington Territory,
February 6, 1854.

Sir: I have the honor to submit herewith four profile maps:

1st. A barometric profile of the route pursued by the main party of the western division of the North Pacific Railroad Exploring Expedition, under your command, from Fort Vancouver to Fort Colville, Washington Territory.

2d. A barometric profile of the Snoqualme Pass, Cascade range, including the valley of Yakima river from its mouth.

3d. A barometric profile of the Nahchess Pass, Cascade range, including the Yakima valley to the mouth of the Nahchess river, and the Nahchess valley.

4. A barometric profile of the valley of the Methow river, from its mouth to the junction of the Twitsp river with the Methow, of the valley of the Twitsp to the junction of the Nahaiecelixon river with the Twitsp, and of the Nahaiecelixon for a distance of three and a half miles from its mouth.

The observations from which the profile was calculated were taken with an English barometer, which was carefully compared with the standard barometers for several days before the expedition left Vancouver. The instrument was a good one, and in good order. The observations were taken either by myself or by my assistant, J. D. Biles, in whose accuracy and fidelity I have perfect confidence, and I believe them to be reliable.

The general profile, it will be observed, terminates at Fort Colville. Unfortunately for its continuance, the barometer (the last and best of the four) was accidentally broken soon after leaving Fort Okinakane. This occurred on the 7th of October, and from that time the observations were taken with an aneroid. A short experience convinced me that the aneroid, however useful for other purposes, is nearly valueless in establishing the profile of an extended line of march.

The aneroidal observations, therefore, have been used only to connect the profile of our route with that of Lieutenant Arnold's party. They occupy only a period of ten days, and that portion of the route between the Okinakane river and the Columbia at Fort Colville, following in the Hudson's Bay Company's trail.

The observations for the passes were taken by yourself, with the same barometer as was used in the observations for the general profile. In calculating the differences of level, I used the tables calculated from Laplace's formula, published by the Smithsonian Institution.

The point of reference for the maps of the Snoqualme and Nahchess Passes is the mouth of the Yakima river. In the observations to establish this point, I am indebted to Lieutenant R. Arnold, third artillery. In the Methow river profile, including the Twitsp and Nahaicelixon, the point of reference is the mouth of the Methow; and in the general profile the starting-point of the expedition is Fort Vancouver.

I should have used the level of the sea as given by Nicollet, thirty inches in this latitude, as the point of reference for the general profile, had it not been for the fact that a series of observations made at Fort Vancouver, with a standard barometer, under my direction, and which extended through a period of several months, gave a mean slightly over thirty inches. Fort Vancouver is one hundred and ten miles from the sea, and, being above the level of the Columbia river, is of course above the sea level.

By consulting the observations made at Vancouver for Wilkes's exploring expedition, I found they also averaged over thirty inches.

For this reason, and the additional one that no observations have been made by either branch of the expedition to establish the usual point of reference, I have taken Fort Vancouver for that point; it being the lowest and nearest the level of the sea.

I am, Captain, very respectfully, your obedient servant,

SYLVESTER MOWRY,
Second Lieut. Third Artillery, in Charge of Meteorological Report.

Capt. Geo. B. McClellan,
Corps of Engineers, Chief of Exploring Expedition, &c. &c.

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36. Report of the meteorology of the route taken by Lieutenant C. Grover, U. S. A., from Fort Benton to Wallah-Wallah.

[Extracts of data from journal.]

Sir: After returning from the survey of that portion of the Missouri river intrusted to my charge, I remained at Fort Benton, on the Missouri, until the 2d day of January, 1854. Up to this date but very little snow had fallen in this section of the country, and what had fallen covered the ground but a few days at a time. The weather, as a general thing, had been mild and even, and the stock of the Fur Company, as well as that of the expedition left here, though depending solely upon the range for subsistence, and without shelter or care, was in fine condition. The Missouri had for a short time during the month of December been closed with ice, but on New Year's day was entirely open. My instructions contemplating the use of dog trains as transportation, every preparation had been completed with the view—dogs purchased, trains prepared, &c., &c.; but the season had thus far advanced without a sufficient fall of snow to enable me to use them. I therefore, on the 2d day of January, left Fort Benton with my party of four men and trains, with an addition of two men with pack-mules; the latter I intended to use until enough snow should fall to enable me to use my trains.

On the evening of the 2d the snow commenced falling, and it continued stormy for some days, during which time about six inches of snow fell. On the morning of the 7th the weather had assumed a more settled appearance, and the snow seemed likely to remain; I therefore sent back my pack-mules and continued on with my dogs. I had reason soon to repent the step, however; for, by the morning of the 9th, all our snow had been carried away by the combined influence of the sun and the southwest wind. I may as well state, in this connexion, that the southwest wind is the prevailing wind in the winter season in this section of the country; and, if it blows for several days in succession, it invariably brings with it mild weather, and cuts down the snow, and frequently drives the ice from the river. On the 9th and 10th we worked along slowly over the bare ground to near the base of the main chain of mountains; but on the morning of the 11th, as we were approaching the dividing ridge, we struck the region of snow and found a cooler atmosphere. On the 12th we passed the dividing ridge, upon which the snow lay to the depth of one foot, and in no place where undisturbed did it exceed this. On the 13th we continued down the Blackfoot fork; the weather now had become quite severe and stormy, and the general direction of the wind (northeast) quite the contrary of what it had been east of the divide. As to the snow, its depth remained about the same from the divide to our debouch into the lower end of the Hell Gate defile, never exceeding one foot, and drifting but very little.

On the 21st we reached the Bitter Root valley and camped on the Bitter Root river. As we approached the valley there was a sensible diminution of snow, and in the valley itself it did not exceed five inches in depth, and a portion of the valley was entirely bare. The next day, the 22d, we arrived at the trading-post of Mr. Owen, who, with great kindness, furnished us with every comfort required. During my stay in this fine valley, preparatory to the continuation of my journey, I could but notice the fine cattle belonging to Mr. Owen and the Indians, (Flatheads,) and never have I seen cattle in better condition anywhere, or in any season, than these were, though entirely unsheltered and uncared for. The cows and young cattle were mostly as fat as stall-fed beeves; and calves a week old and younger were running at large on the range. I was informed by Mr. Owen that he never lost his calves from the inclemency of the weather, though he never housed his stock or fed them. The mildness of this valley may be regarded as remarkable, considering its latitude. As soon as the Flatheads heard of my arrival from the country of the Blackfeet, the principal chiefs convened and called on me, anxious to hear the news from the other side of the mountains. They had been informed by you previously of the promises of the Blackfeet to desist from war; but they had been so oppressed and impoverished by them for many years, that they heard the news with distrust, and their fears had been realized, weeks before I arrived there, by another descent of the Blackfeet upon them, by which they lost several horses. They were now anxious to learn if any war parties were out, and what was their destination. I informed them that there were six hundred young men on war parties on the Crows, but none that I knew of looking towards their country. In fact, the Flatheads generally have a resting spell during the winter, as in this season war parties cannot take back the horses they steal; and as that is the great object of their expeditions, they wait till spring.

At this point I found it would be impracticable to continue farther with dogs, as about three-fourths of the distance between this and Wallah-Wallah was entirely destitute of snow. I therefore prepared to pursue my journey with pack-mules and Indian ponies. These I procured from Lieutenant Mullan, who held in charge a large number of animals belonging to the expedition, which had been unable to proceed on with the main party in the fall, owing to their reduced condition, but had so far recovered at this time as to be able, in our opinion, to take the trip. Accordingly, on the 29th I sent back to Fort Benton two of my men who had engaged to come only this far, with one train and four dogs; the remaining trains and dogs I abandoned, and, having laid in a new supply of provisions, on the 30th left Fort Owen. The weather for the last few days had become much milder, and the snow had all disappeared from the valley, and the ice had mostly left the river. We followed down the Bitter Root river to its junction with Hell Gate fork, and crossed the latter on the evening of the 31st. On the 1st of February, in our general course down the stream formed by the junction of the Blackfoot and Hell Gate forks, we passed through the defile of Coriacah, in which a few inches of snow were found. From this point to Thompson's prairie our course lay mostly through mountain defiles and small prairies. We arrived at the above-named prairie on the night of the 5th.

From Fort Owen up to this point there had been no snow except on the mountain-tops, and in the defile before mentioned grass had been very good; and in the numerous small prairies, among which Camash prairie and Horse plain may be mentioned, herds of Indian horses, which had been left there by their owners to winter, were grazing, all in fine condition. On Thompson's prairie there was an unusual number of them, for this had been made the depot for the horses of all travelling west this season, under the impression that they would be unable to take them farther, on account of snow and want of grass. The latter obstacle I had partially prepared for by taking along a few bushels of grain. From the morning of the 7th to the night of the 15th, when we camped near the Pend d'Oreille lake, our general course was down the Flathead river through a densely-wooded country, perfectly devoid of grass even in the summer. The snow had gradually increased in depth from Thompson's prairie for about fifty miles west, when it had reached the depth of two feet on an average, and remained about this depth to within a few miles of Pend d'Oreille lake, when it began to decrease, and in the immediate vicinity of the lake was not over one foot in depth. The travelling for the last seven days had been severe on the animals, though none of them had given out, notwithstanding their want of feed. As we continued westward along the lake-shore the snow continued to decrease, and now and then a fine field of grass was found.

On the 17th a mule and a horse gave out, and I was obliged to leave them, which I did, in good grass. On the 18th crossed Clark's fork of the Columbia, which was nearly clear of ice; and on the 19th commenced the passage from the river to the Cœur d'Alene prairie, a distance of about sixty miles. This distance we intended to make in two days, but our guide was unable to follow the trail on account of snow, and consequently we did not reach the prairie till the night of the 22d. The travelling was worse these last four days than it ever had been before. The snow for most of the way was two and a half feet deep, and very hard. The forest was dense, and grass exceedingly scarce. As we left this forest we left the snow for the last time. The prairie was covered with fine grass, and the stock on this plain was in nearly as good condition as that in the Flathead country.

Here I was obliged to procure a relay of horses and leave mine, for they were entirely unable to continue on to Wallah-Wallah. With fresh animals the Spokane prairie is seven travelling days from Wallah-Wallah, and as the travelling was good, and the streams mostly were fordable, we arrived there on the 2d of March. We found no lack of grass at any point. On the 3d we continued on down the Columbia, and arrived at the Dalles early on the 7th. Grass here, at this season of the year, may be considered fair, but I should judge it would be very scarce in the season of emigration. The principal feature of the weather, since leaving the Flathead village, has been its dampness and storminess; scarcely a day passed, during the whole time, that was entirely pleasant.

The above statement I have endeavored to make as short as possible, and, at the same time, to contain all that relates to the subject in question. I have not noticed, in any manner, the topography or resources of the country, or what I saw of the manners or customs of the Indians, as you have already all those things before you.

Very respectfully, C. GROVER.

His Excellency I. I. STEVENS, *Governor of Washington Territory.*

Date.		Temperature.			Remarks.
		Sunrise.	Noon.	Sunset.	
		°	°	°	
Jan.	2	....	....	55, 50	High SW. wind; heavy clouds.
	3	20	12	6, 13	Wind NE., (sunset;) snowing.
	4	—12	—10	—16, —13	Wind NNW.; at sunrise, snowing; wind W. sunset; clear.
	5	—11	....	1, —4	Wind SSW. strong, (sunrise;) same noon; wind S. sunset.
	6	20	17	20, 19	Wind SW.
	7	30	33	32, 32	Wind SW.
	8	35	51	46, 44	Wind SW.
	9	39	44	38, 40	Wind SW.
	10	16	36	28, 27	Wind SW., (noon and night.)
	11	32	32	32, 32	Wind W.
	12	—16	—21	—18, —18	Wind NE.; (noon observations taken on dividing-ridge.)
	13	—24	—19	—23, —22	Wind NE.; stormy all day.
	14	—25	—15	—16, —19	Wind NE.
	15	—34	— 1	—18, —18	Clear.
	16	—38	— 1	—21, —20	Clear.
	17	— 8	8	— 1, — 0, 3	Wind NE. and snowing at sunset.
	18	—13	....	— 6, — 9	Snowing at sunset a little.
	19	—16	— 8	—14, —13	A little snow fell at night.
	20	—23	— 2	— 6, —10	
	21	+ 1	7	9, +6	Wind at sunrise NE., and snowing; at sunset, wind SW.; clear.
	22	+ 1	7	+4	Arrived at Fort Owen.
	30	....	42	39	Cloudy.
	31	55	52	42	Wind SW.; rainy.
Feb.	1	28	25	25	
	2	13	34	26	
	3	13	39	39	Wind SW. at sunset; cloudy.
	4	36	42	39	
	5	15	42	30	
	6	26	34	35	Wind SW.; sunrise, cloudy.
	7	33	41	36	Wind SW.
	8	33	45	37	Wind SW.; at sunset NW., overcast.
	9	34	42	37	
	10	30	39	35	
	11	33	35	30	
	12	23	35	30	Cloudy; snowing a little.
	13	28	36	30	
	14	15	28	26	Cloudy.
	15	22	26	25	
	16	23	37	28	Cloudy.
	17	25	32	30	Cloudy; NW. wind in the morning.
	18	26	39	32	Cloudy; snowed a little in the morning.
	19	15	42	28	Cloudy.
	20	26	37	34	Snowing.
	21	29	41	34	Cloudy.
	22	24	42	38	
	23	33	38	34	Some snow fell in the morning.
	24	25	51	33	
	25	33	40	35	
	26	32	42	35	Wind SW.
	27	35	47	41	Wind SW.
	28	31	46	45	
March	1	41	45	42	
	2	33	45	....	Arrived at Wallah-Wallah.

37. REPORT OF MR. TINKHAM OF THE SNOWS OF THE ROCKY MOUNTAINS IN NOVEMBER, OF THE BITTER ROOT IN DECEMBER, AND OF THE CASCADES IN JANUARY.

WASHINGTON, D. C., *August* 12, 1854.

SIR: As requested in your note of to-day, I give herewith, in brief, facts relating to snow as they were noticed in my recent exploration.

In October, 1853, I left the valley of St. Mary's river; passing to the eastward, and recrossing the Rocky mountains, was in the prairies at their eastern base from late in October to near the middle of November; crossed again the Rocky mountains about the middle of November; was in the Bitter Root range of the Rocky mountains during most of December; and, finally, crossed the Cascade mountains during January.

On the divide of the Rocky mountains at Marias Pass I found no snow when crossing, October 20th, (save what little snow of the previous winter remained in the narrow valley at the base of the divide,) but the snow commenced falling that night; and much of the time spent in the prairies, until I again crossed the mountains by the Little Blackfoot Pass, was cold and snowing. The snow accumulated but little, and attained a greatest depth of eight inches. The thermometer often ranged nearly as low as zero.

On the final crossing of the Rocky mountain summits, by the Little Blackfoot Pass, an inconsiderable depth of snow lay on the ground, perhaps an inch or two; and save occasional snow-squalls occurring during the descent of Little Blackfoot and Hell Gate rivers, I encountered little until I entered the Bitter Root range of mountains, November 21st. In the St. Mary's valley, at that time, there was no snow, and the weather was mild.

The passage of the Bitter Root range was made between November 21st and December 18th. Excepting occasional small valleys, the whole of this mountain district in the southern Nez Perces trail was covered with snow; having, as I judged, a greatest depth of six feet, and an estimated average depth of near two feet for the whole breadth of the mountains.

I reached Wallah-Wallah, on the Columbia, on the 30th day of December. From the Bitter Root mountains to this place I found no snow; some on the high plains not far from the mountains, where, for a short distance, it was eight inches deep.

In the valley of the Yakima the first snow observed was seen seventy-five miles above the mouth of the river, and then, on January 13th, it was two or three inches deep. Crossing the Cascade mountains, January 21st, by the Yakima Pass, for a few miles the snow was six feet deep, very rapidly decreasing in the western slope; the whole breadth, over twelve inches deep, was somewhat less than sixty miles in extent.

Of this, about forty-five miles were two feet deep and upwards, about twenty miles were four feet deep and upwards, and six miles were six feet deep.

I am, sir, very respectfully, your obedient servant,

A. W. TINKHAM.

Governor Isaac I. Stevens,
Chief of North Pacific Railroad Exploration, Washington, D. C.

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38. Letter of the Hon. H. M. Rice, and extracts from letters of Hon. H. H. Sibley and A. Culbertson, Esq., as to the winter climate of the region extending from the Mississippi River to the base of the mountains. (For much additional information in regard to snows, see the several reports of Lieutenant Mullan.)

[Letter from Hon. H. M. Rice.]

Washington, *June* 3, 1854.

Dear Sir: Your note of yesterday, asking me to make a memorandum in reference to the winter climate of Minnesota, has been received. Navigation of the Mississippi river closes from the 10th to the 25th of November, and opens from the 1st to the 10th of April. That of the Red river of the North closes from 1st to 15th November, and opens from 10th to 25th April. I have often travelled in the winter from St. Paul to Crow Wing, a distance of one hundred and fifty miles, with a single horse and sled, without a track, and have never found the snow deep enough to impede my progress. I have also gone from Crow Wing, beyond the headwaters of the Mississippi, to the waters of the Hudson's bay, on foot and without snow-shoes. I spent one entire winter travelling through that region, and never found the snow over eighteen inches deep, and seldom over nine inches.

For several years I had trading-posts extending from Lake Superior to the Red river of the North, from 46° to 49° north latitude, and never found the snow so deep as to prevent supplies being transported from one post to another with horses. One winter, north of Crow Wing, say 47° north latitude, I wintered about sixty head of horses and cattle without giving them food of any kind except such as they could procure themselves under the snow. Between the 45th and 49th degrees north latitude, the snow does not fall so deep as it does between the 40th and 45th degrees; this is easily accounted for, upon the same principle that in the fall they have frosts much earlier near the 40th than they do near the 45th degree. I say this in reference to the country watered by the Mississippi river. Owing to its altitude the atmosphere is dry beyond belief, which accounts for the absence of frosts in the fall, and for the small quantity of snow that falls in a country so far north. Voyageurs traverse the territory from Lake Superior to the Missouri the entire winter with horses and sleds, having to make their own roads, and yet with heavy loads are not detained by snow. Lumbermen, in great numbers, winter in the pine regions of Minnesota with their teams, and I have never heard of their finding the snow too deep to prosecute their labors. I have known several winters when the snow at no time was over six inches deep.

Very truly, yours,

HENRY M. RICE.

[Extract from letter of Hon. H. H. Sibley.]

MENDOTAH, M. T., *June* 6, 1854.

You desire me to state briefly some facts connected with our winters—"the depth of snow, the drifting of snow, the temperature, the practicability of travelling with animals, the habits and the mode of subsistence of Indians during the winter, &c." I have time at present to reply in very short terms to these inquiries.

It is rarely the case that in this part of the Territory (45° north latitude) the snow reaches a depth exceeding fourteen or fifteen inches. Indeed, I have known two or three successive winters when there was not enough snow to make tolerable sleighing, but these were exceptions to the general rule. As our country is for the most part composed of prairie, it is of course much exposed to the action of the winds. It is, however, a peculiarity of our climate, that calms prevail during the cold weather of the winter months; consequently the snow does not drift to anything like the extent experienced in New England or northern New York. I have never believed that railroad communication in this Territory would be seriously impeded by the depth or drift of snow, unless, perhaps, in the extreme northern portion of it. We have a few days of very cold weather in each winter, when the mercury falls as low as twenty-eight or thirty degrees below zero, but such weather never continues for any length of time. Generally speaking our winters are uniformly dry and clear, without rain or much thawing weather previous to the month of March. Navigation from St. Paul is usually open until the 15th or 20th of November, and boats are looked for about the first week in April. The Mississippi may, therefore, be regarded as closed by ice a little more than four months in the year.

In the month of October, or earlier, as their crops of corn mature sooner or later, the Sioux Indians abandon their summer dwellings of bark, and betake themselves to their hunting grounds, living during the winter in their portable conical lodges, made of dressed buffalo-skins. They transport upon the backs of their *women* and *horses* as much corn and wild rice as can conveniently be borne; but the main dependence of the camp is upon the meat of the buffalo, elk, deer, and bear, furnished by the hunters. This mode of subsistence is becoming more and more precarious as the game is destroyed or driven off, so that these Indians must resort to the cultivation of the soil to a much greater extent than they do, or perish. The annuities paid even to the most wealthy of the western tribes are utterly insufficient of themselves to support them.

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[Extract from letter of A. Culbertson, Esq.]

ST. JOSEPH, *June* 8, 1854.

In regard to my observations of the snow on the upper Missouri during upwards of twenty years, I find, by referring to notes taken of trips during the winter season from St. Louis to Fort Benton, that the snows differ from one year to another. The average depth might be estimated at twelve inches, say from the first of December until the first of March; frequently, however, the snow does not exceed six inches. In the vicinity of Fort Benton snows are very moderate, and scarcely ever lie longer than one month at a time until they disappear. The climate is a good deal similar to that of the Eastern States. The winters from the Yellowstone down are much more severe, the snow during high winds drifting so that it is impossible for the traveller to march during these storms; they, however, seldom last over twenty-four hours. I have never seen snow drift deep enough to stop me on my way. * * * * * * *

J.

INDIAN AFFAIRS.

39. REPORT OF MR. GEORGE GIBBS TO CAPTAIN MC'CLELLAN, ON THE INDIAN TRIBES OF THE TERRITORY OF WASHINGTON.

OLYMPIA, WASHINGTON TERRITORY,
March 4, 1854.

SIR: Herewith I have the honor to submit my report upon the subject of the Indian inhabitants of Washington Territory; and to be,

Very respectfully,
GEORGE GIBBS.

Capt. GEORGE B. MCCLELLAN,
Commanding Western Division N. P. Railroad Exploration.

REPORT.

In considering the general subject of the Indian tribes of this Territory, two natural divisions present themselves, separated by a marked and definite boundary—the Cascade mountains—on either side of which the native inhabitants differ not less than the geographical features of the country.

It will be proper to examine them in turn, taking up the various tribes of each division in order, and appending such observations in regard to their management as the most careful inquiry practicable has suggested.

In this connexion, the word "nation" will be used of the whole people speaking a common language, and "tribe" as comprehending the bands organized under one head.

And first of the interior or eastern section.

Those living between the Cascade and Rocky mountains, within the limits of this Territory, or extending into it, are, first, the Wallah-Wallah nation, under which term is embraced a number of bands living usually on the south side of the Columbia, and on the Snake river to a little east of the Peluse; as also the Klikatats and Yakimas, north of the former. The first may be, for the present purpose, classed together as the Wallah-Wallah *tribe*. The greater part of their country, it will be seen, lies in the adjoining Territory of Oregon, and it is proposed should remain under the direction of that superintendency. The number of these bands was in 1851 stated by Dr. Anson Dart, then superintendent of Indian affairs, at 1,093; a part of whom, however, belonged to the Upper Chinooks. The whole number is since much diminished by the smallpox. The present population is probably reduced to 600, of whom the majority are in Oregon Territory. The head chief of the Wallah-Wallahs is Pu-pu-mux-mux, or the Yellow Serpent—an old man, who generally makes his residence near Fort Wallah-Wallah. His influence with his people is said to be good as far as it goes, but he does not exercise it beyond his immediate band. This tribe have been notorious as thieves since their first intercourse with the whites. They, as well as their neighbors, the Nez Perces, own large bands of horses, which roam at large over the hills south of the Columbia, and their principal wealth consists in them. There is no wood in their country, and they depend upon the drift brought down by the stream for their fuel. Their very canoes are purchased from the Spokanes. They move about a great deal, generally camping in winter on the north side of the river. Their fisheries at the Dalles, and at the falls ten miles above, are the finest on the river. The expedition passed through the Wallah-Wallah country on its return route, but no official intercourse took place with the tribe. They, as well as the Nez Perces and Cayuses, are at present included in the agency of Mr. R. R. Thompson, of Oregon. At the crossing of Snake river, at the mouth of the Peluse, we met with an interesting relic. The chief of the band, Wattai-wattai-how-lis, in coming to visit Captain McClellan, exhibited, with great pride, the medal presented to his father, Ke-powh-kan, by Captains Lewis and Clark. It is of silver, double, and hollow, having on the obverse a medallion bust, with the legend, "Thomas Jefferson, President U. S. A., 1801;" and on the reverse the clasped hands, pipe, and battle-axe, crossed, with the legend, "Peace and Friendship."

The Klikatats and Yakimas will remain to the Washington superintendency. The former inhabit, properly, the valleys lying between Mounts St. Helens and Adams, but they have spread over districts belonging to other tribes, and a band of them is now located as far south as the Umpqua. Their nomadic habits render a census very difficult, though their number is not large. Dr. Dart stated them at 492; since when, there has certainly been a great decrease. The number of the two principal bands, as obtained during the summer, was, at the Chequoss 138, and at the Kamas plain 84. These must have constituted the chief part, as it was the season of berries when they congregated there. Including all others within the Territory, the total does not probably exceed 300. In this, however, are not reckoned the Tai-tin-a-pam, a band said to live apart in the country lying on the western side of the mountains, between the heads of the Cathlapoot'l and Cowlitz, and which probably did not enter into the former estimate. But little is known of them, and their numbers are undoubtedly small. The head chief of the Klikatats is a very old man, named Towe-toks. He evidently possesses but little influence, his people paying much more respect to his wealthier neighbors, Ka-mai-ya-kan, Skloo, and the other chiefs of the Yakimas.

The Klikatats and Yakimas, in all essential peculiarities of character, are identical, and their intercourse is constant; but the former, though a mountain tribe, are much more unsettled in their habits than their brethren.

This fact is probably due, in the first place, to their having been driven from their homes, many years ago, by the Cayuses, with whom they were at war. They thus became acquainted with other parts of the country, as well as with the advantage to be derived from trade. It was not, however, until about 1839 that they crossed the Columbia, when they overran the Willamette valley, attracted by the game with which it abounded, and which they destroyed in defiance of the weak and indolent Callapooyas. They still boast that they taught the latter to ride and to hunt.

They manifest a peculiar aptitude for trading, and have become to the neighboring tribes what the Yankees were to the once Western States, the travelling retailers of notions; purchasing from the whites feathers, beads, cloth, and other articles prized by Indians, and exchanging them for horses, which in turn they sell in the settlements. Their country supplies them with an abundance of food. The lower prairies afford kamas, and the mountains a great variety of berries in profusion. The business of gathering these of course falls on the women, who go out in small parties, attended by a boy or old man as camp-keeper, collect and dry the berries, or bring into the general camp what is wanted for present food. Such of them as bear keeping they store for winter use, and also for trade, exchanging them for fish, smoked clams, and the roots which their own territory does not furnish.

Of game, there is but little left. The deer and elk are almost exterminated throughout the country, the deep snows of winter driving them to the valleys, where the Indians, with their usual improvidence, have slaughtered them without mercy. The mountain goat, and the big-horn, or sheep, are both said to have formerly existed here, but, since the introduction of fire-arms, have retired far into the recesses of the Cascades. The black bear alone is still found, though but rarely. The salmon furnishes to these, as to most other tribes of the Pacific, their greatest staple of food. Their neighborhood to the fisheries of the Cascades and the Dalles provides them for the summer; while, after the subsidence of the Columbia, later schools ascend the small rivers, and in the autumn an inferior kind forces its way into the brooks, and even the shallow pools which form in the prairies.

Very few attempt any cultivation of the soil, though their lower prairies would admit of it. We were informed, however, that the next season many of them intended to build houses there and plant potatoes. Their usual residence during the summer is around Chequoss, one of the most elevated points on our trail from Fort Vancouver across the Cascades, where we met them at the beginning of August. They were, at this time, feasting on strawberries and the mountain whortleberry, which covered the hills around, though during the night the ice formed on the ponds to the thickness of half an inch. Towards the end of the month they descend to the Yahkohtl, Chalacha, and Tahk prairies, where they are met by the Yakimas, who assemble with them, for the purpose of gathering a later species of berry and of racing horses. The racing season is the grand annual occasion of these tribes. A horse of proved reputation is a source of wealth or of ruin to his owner. On his speed he stakes his whole stud, his household goods, clothes, and finally his wives; and a single heat doubles his fortune, or sends him forth an impoverished adventurer. The interest, however, is not confined to the individual directly concerned; the tribe share it with him, and a common pile of goods, of motley description, apportioned according to their ideas of value, is put up by either party, to be divided among the backers of the winner. The Klikatats themselves are not as rich in horses as those living on the plains, their country generally affording but little pasturage, and the deep snows compelling them to winter their stock at a distance from their usual abodes. The horse is to them what the canoe is to the Indians of the river and coast. They ride with skill, reckless of all obstacles, and with little mercy to their beasts, the right hand swinging the whip at every bound. Some of the horses are of fine form and action; but they are generally injured by too early use, and sore backs are universal. Indiscriminate breeding has greatly deteriorated what must have been originally a good stock, and the prevalence of white and gray in their colors is a great objection. Wall-eyes, white noses and hoofs, are more than common among them. They are almost always either vicious or lazy, and usually combine both qualities. In their capacity for a continued endurance, they are overrated. A good American horse is as much superior to them in this, as in speed; but they are hardy, and capable of shifting with but little food. Nothing is known of their first introduction. They were abundant when the country was discovered. It is probable that the Shoshonees or Snakes, a branch of the Camanches, first introduced them from the South, and that the breed has since been crossed by others from Canada. The best are those belonging to the Cayuses and Nez Perces. The demand for horses, consequent upon the settlement of the country, has rendered the tribes possessing them really wealthy.

Their price is from $40 to $100, but they have some which they will not dispose of at much higher rates. A few of the chiefs have great numbers, and one, it is said, has offered 400—a by no means contemptible dowry—to any respectable white man who will marry his daughter.

The Indians ride with a hair-rope knotted around the under jaw for a bridle. The men use a stuffed pad, with wooden stirrups. The women sit astride, in a saddle made with a very high pommel and cantle, and in travelling carry their infants either dangling by the cradle-strap to the former, or slung in a blanket over their shoulders; while children of a little larger growth sit perched upon the pack-animals, and hold on as best they may.

The horses are trained to stand for hours with merely a lariat thrown loosely around their necks, the end trailing upon the ground. With the whites they are at first as shy as are American horses or mules with the Indians; but they suffer handling from the squaws and children with perfect contentment, and hang around the huts like dogs. When camping near them we often found the horses an intolerable nuisance, from their incessant whinnying during the night. Whenever the musquitoes were abundant they posted themselves in the smoke of the fires. It is the business of the squaws in travelling to pack the animals, the men contenting themselves with catching them up; and they pile on the most heterogeneous assortment of luggage with a skill that would immortalize a professional packer. In breaking horses the Indians usually blind them before mounting, often tying down their ears in addition. A strap or cord is then passed around the body of the animal, loose enough to admit the knees of the rider. Much time is spent in soothing and quieting the beast, as the Indian has plenty of it upon his hands. When everything is ready he vaults to his back, always from the off-side, slips his knees under the girth and tightens it, withdraws the muffle, and sits prepared for a series of stiff-legged plunges, ending in a charge. If the horse throws himself—for throw his rider he cannot—the quick straightening of the leg releases the knee, and he is prepared for the emergency.

In describing the household goods of the Indian, his dogs are not to be forgotten. They vary considerably in form with different tribes, but always preserve the same general character. Quarrelsome and cowardly, inveterate thieves, suspicious and inquisitive, they are constantly engaged in fights among themselves, or in prowling around the lodges for food. The approach of a stranger is heralded by short, sharp yelps, succeeded by a general scamper. They all bear the same mysterious resemblance to the cayote—the sharp muzzle, erect ears, and stiffly curling tail. Notwithstanding their worthlessness, they seem to have a strong attachment to their owners, and an Indian camp would be a novelty without its pack of curs. Very few characteristic features remain among these people. Their long intercourse with the Hudson's Bay Company, and of late years with the Americans, has obliterated what peculiarities they may have had; nor is there any essential difference in their habits or manners from those of the Indians adjoining them. They use, for the most part, the arms and utensils of the whites, and the gun has superseded the bow. The pails and baskets, constructed from the bark of the cedars, saddles and fishing apparatus, are their principal articles of domestic manufacture; and even of such things it is almost as common to find the imported substitutes.

In regard to moral character they are much superior to the river Indians; not that perfect virtue is by any means to be expected, but they are more strict in respect to their women, particularly the married ones, and they are far less thievish.

Their mode of disposing of their dead, like that of their kindred tribes, is in the ground, but without any attempt at coffins, the body being merely wrapped in its clothing. Just before our arrival at Chequoss a man had died of the smallpox, and those who had buried him were purifying themselves. During the three days occupied in this, they absented themselves from camp, alternately using the sweat-house and plunging into cold water.

The house, which was a small oven-shaped affair, was heated with stones. The mourning is performed by the women, who live apart for a few days, and afterwards bathe and purify themselves. They have the common objection to mentioning the names of the dead, as well as their own. The practice of medicine, as elsewhere, consists in incantations, and is attended with the usual hazards; the life of the practitioner answering for the want of success, or a refusal to attend when properly feed. Besides these mummeries, however, they use certain plants as medicines, among which are both emetics and cathartics. The patriarchal institutions of slavery and polygamy are yet retained among them; the number of wives being limited only by the wealth of the husband, for with them it is the *woman* who is sold.

A curious custom exists, exhibiting their savage ideas of equity as opposed to the common-law maxim of "*caveat emptor*." If a wife dies within a short period after marriage, the bereaved husband may reclaim the consideration from the father; so also with slaves and horses. No systematic attempt has, it is believed, been made to convert the Klikatats to Christianity, although many individuals have come in contact with missionaries of some denomination. Several of those at Chequoss have had instruction from the Rev. Jason Lee and others, formerly at the Dalles.

The old chief Tow-e-toks preserved a paper on which some one made a sort of calendar or record of the days of the week. He expressed great anxiety lest, as it was nearly worn out, he should be unable to distinguish the Sundays, and requested me to prepare him a new one. He added that he was in great fear of death, and constantly "talked to the Chief above." As will readily be imagined, the remarkable features of this mountain scenery, and the neighborhood of the great snow peaks—Mount St. Helens and Mount Adams—give a color to the legends of the Klikatats. They, in common with the other Oregon tribes, seem to have had no distinct religious ideas previous to those introduced by the whites, nor any conception of a Supreme Being. Their mythology consists of vague and incoherent tales, in most of which Ta-la-pus, or the prairie wolf, figures as a supernatural power. Besides him there are other agents, among whom a race denominated the "Elip Tilicum," from two jargon words signifying "first people," or "people before," figure prominently. Though trifling in themselves, yet, as specimens of what may be considered the unwritten literature of the Indians, they may not be uninteresting—the more especially as the belief in the existence of those giants seems to be of universal currency throughout Oregon. The following are among them:

In descending the valley from Chequoss, there occurs beneath a field of lava a vaulted passage, some miles in length, through which a stream flows in the rainy season, and the roof of which has fallen in here and there. Concerning this they relate that a very long time ago, before there were any Indians, there lived in this country a man and wife of gigantic stature. The man became tired of his partner, and took to himself a *mouse*, which thereupon became a woman. When the first wife knew of this, she was very naturally enraged, and threatened to kill them. This coming to the man's knowledge, he hid himself and his mouse-wife in a place higher up the mountain, where there is a small lake having no visible outlet. The first woman finding that they had escaped her, and suspecting that they were hidden underground, commenced digging, and tore up this passage. At last she came beneath where they stood, and looking up through a hole, saw them laughing at her. With great difficulty, and after sliding back two or three times, she succeeded in reaching them; when the man, now much alarmed, begged her not to kill him, but to allow him to return to their home and live with her as of old. She finally consented to kill only the mouse-wife, which she did, and it is her blood that has colored the stones at the lake. After a time the man asked her why she had wished to kill the other woman. She answered, because they had brought her to shame, and that she had a mind to kill him too; which she finally did, and since when she has lived alone in the mountains.

Another story about the same place is to the effect that it was made by a former people called the Siam, a name corresponding with the jargon word for grizzly bear. The mouse story appears to be interwoven with the Klikatat mythology, for besides the name of this place, Hool-hool-se, (from hool-hool, a mouse,) one of the names of their country is Hool-hool-pam, or the mouse-land. This is given to it by the Yakimas. Both versions, as well as many others of their tales, refer to their Indian Pre-adamites, the Elip Tilicum; to whom, and to the Ta-la-pus, as many wonders are attributed as among Christians to Satan.

Concerning the Ta-la-pus, this story is related by the Klikatats in connexion with a favorite valley—the Tahk prairie. This was formerly the bed of a lake, the remains of which now appear in a marshy pond of some extent. The wolf, when the prairie was made, promised that it should be rich in their favorite roots, the kamas and the wápp-a-too; and likewise that the salmon should come there in abundance. But the Indians, forgetful of their obligation to him, showed no gratitude, and when they came there, spent their time in horse-racing and gambling, instead of fishing and the business of life; wherefore the wolf took away the salmon, and placed two stones upon the prairie, beyond which they should not pass.

Alas, for the perverseness of man! notwithstanding the punishment, the Klikatats and their friends run horses and gamble there to this day.

There is also, in contrast with the gigantic race above mentioned, a story of one of diminutive size, but a span high, who lived near the foot of the St. Helens, and whose footprints the Indians have seen where they held their nocturnal dances. Since the eruption of 1842, it may be mentioned, they have not ventured to ascend Mount St. Helens. They have also tales connected with certain of the constellations, many of which are named. The Great Bear, for instance, is called "spilyeh," or the wolf. The Yakimas occupy the country drained by the river of that name. They are divided into two principal bands, each made up of a number of villages, and very closely connected; the one owning the country on the Nahchess and lower Yakima, the other upon the Wenass and main branch above the forks. Over the first there are three chiefs—Kam-ai-ya-kan and his brothers Skloo and Sha-wa-wai. Over the latter, Te-éh-yas and Ow-hai. Of all these, Kam-ai-ya-kan possesses the greatest influence, none of the others undertaking any matter of importance without consulting him. Skloo is accused of being tyrannical and overbearing with his weaker neighbors, and Sha-wa-wai of being indolent and wanting in force.

Kam-ai-ya-kan is, in turn, much under the influence of the missionaries, with whom he lives altogether. The others are both intelligent, and bear very good characters. All of them appear to be well disposed and friendly towards the whites, whose superiority they have sense enough to understand.

Most of what has been said of the Klikatats is applicable also to the Yakimas, though, from the nature of their country, some difference in their modes of life is of course observable. Their name, it may be mentioned, is not an appellation of their own. It is said to be the word signifying a black bear in the Wallah-Wallah dialect. West of the mountains, both at Vancouver and at Puget sound, they also are generally called Klikatats. Like the last, they live in rude huts covered with mats, the distance of their winter habitations from timber rendering the construction of houses inconvenient; a reason, however, which does not exist with the others. They raise potatoes, a few melons and squashes, together with a little barley and Indian corn. The latter is of the eight-rowed variety, and what we saw of it very small and stunted, the ears being not over five inches long. The potatoes were generally very fine, and of several varieties; of which we noticed the lady-finger, mercer, and blue-nose. Their gardens were, for the most part, situated in the little valleys running up towards the mountains, and near enough to the streams to receive moisture during the early summer. They were rudely fenced around to exclude animals. This invaluable addition to their means of subsistence, it should be said, they, in common with many other tribes, owe to the Hudson's Bay Company. The country around the northern or main branch of the Yakima is frequently called by them Pschwan-wapp-am, or the stony ground, and the Indians living there sometimes assume the name to themselves. Besides the fisheries at the Dalles, the Yakimas have others in their river, up which the salmon run without interruption far into the mountains. On the main fork, in particular, they penetrate to Lake Kitchelus, at the very foot of the dividing ridge. In addition to the different kinds of salmon proper, they have also the salmon-trout, two varieties of the speckled trout, the red and black spotted, both of them growing to a large size; and some other species of fresh-water fish.

The salmon they take in weirs and cast-nets. The weirs are constructed with considerable skill, upon horizontal spars, and supported by tripods of strong poles erected at short distances apart, two of the legs fronting up stream, and one supporting them below. There are several of these weirs on the main river fifty or sixty yards in length. The cast-nets are managed by two men in a canoe, one of whom extends it with a pole and the other manages the rope. Their canoes are of very rude workmanship, compared with those belonging to tribes of more aquatic habits, being simply logs hollowed out and sloped up at the ends, without form or finish.

Another article of food obtained from the rivers is the unis, or fresh-water muscle, of which there are several varieties. Deep beds of their shells are found near the sites of villages on the river.

Of game the Yakima country is as destitute as that of the Klikatats—so much so that ten deer-skins will purchase a horse. The sage-fowl and sharp-tailed grouse are abundant. The chiefs possess a considerable number of cattle, which, in the summer, find good bunch-grass on the hills. In winter they are driven to great straits for subsistence, being compelled, when the snow lies deep, as it does in the valleys, to browse upon the tops of the wild sage, or artemisia. In horses they are well off, though not rich as compared with adjoining tribes. A portion of the Yakimas, more particularly those living on the main river, in hunters' language, "go to buffalo," joining the Flatheads in their hunts; but these expeditions are probably far more rare than formerly, when, with greater numbers, they and their allies carried war against the Blackfeet beyond the mountains. With the tribes on Puget sound they communicate continually during the summer by the Nahchess and main Yakima passes, taking horses for sale to Nisqually, and purchasing "hai-qua," dried clams, and other savage merchandise, on their return. The Yakimas have, like the Klikatats, during the past year suffered severely from the smallpox; the village at the Dalles in particular, the Wish-ram of evil notoriety, in Mr. Irving's Astoria, having been depopulated.

Individuals among them profess to have some remedy for the disease. Father Pandozy, one of the missionaries among them, informed me that he believed it to be the root of a species of iris. He had once tasted it, and it acted as a violent emetic. The Spokanes have also another and different specific. It is known to but few persons, having been gradually forgotten since the former visitation. Recently, when it broke out in one of the Spokane villages, an old woman, who was blind, described it to her daughter and directed her to proceed towards Kam-ai-ya-kans, and that if she encountered none in her way, to get from him some of that which he used. The girl, however, did find the herb and returned with it. The mother prepared the medicine, and the smallpox was stayed, but not until it had nearly destroyed the village. We were not successful in obtaining specimens of this plant, but Father Pandozy kindly promised to save some when opportunity offered. In regard to this disease, the greatest scourge of the red man, it has passed through this region more than once, and was probably the first severe blow which fell upon the Oregon tribes. Its appearance seems to have been before any direct intercourse took place with the whites, and it may have found its way northward from California. Captains Lewis and Clark conjectured, from the relations of the Indians, and the apparent age of individuals marked with it, that it had prevailed about thirty years before their arrival. It also spread with great virulence in 1843. From the other, and no less sure, destroyer of the coast tribes, the venereal, the Yakimas, and generally the Indians east of the mountains, are, as yet, exempt. Spirituous liquors have never been introduced into their country, at least beyond the neighborhood of the Dalles.

That a population very considerably more numerous than the existing one formerly occupied this region, there can be no doubt. The estimates of Lewis and Clark gave a sum of 3,240 for the bands on the Klikatat and Yakima rivers, without including those upon the Columbia, which amounted to 3,000 in addition. The whole course of the Yakima is lined with the vestiges of former villages now vacant. A very interesting subject of inquiry has been pursued by Mr. Schoolcraft, in his endeavor to follow the earth-works of the Ohio and Mississippi valley into the region west of the Rocky mountains. A careful inquiry among the officers of the

Hudson's Bay Company, and the most intelligent free trappers of Oregon, had satisfied me that none such existed in the country. During an examination of the lower Yakima, however, the old Indian guide who accompanied me pointed out, on the left bank, a work which may possibly be considered as belonging to the same system, although being, so far as is known, a solitary one, it is somewhat questionable.

The work consists of two concentric circles of earth about three feet high, with a ditch between. Within are about twenty cellars situated without apparent design, except economy of room. They are some thirty feet across and three feet deep, and the whole circle eighty yards in diameter. We had no time to examine it more particularly, and no tools to excavate. The ground was overgrown with artemisia bushes, but, except the form of the work, there was nothing to attract particular attention, or lead to the belief that it was the remains of any other than a Yakima village. Our guide, however, who was great authority on such matters, declared that it was made very long ago, by men of whom his people knew nothing. He added that there was no other like it. It is well posted for defence in Indian warfare, being on the edge of a terrace about fifteen feet high, a short distance from the river, and flanked on either side by a gully.

Outside of the circle, but quite near it, are other cellars unenclosed, and in no way differing from the remains of villages frequently met with there. The Indian also pointed out, near by, a low hill or spur, which in form might be supposed to resemble an inverted canoe, and which he said was a ship. It deserves investigation, at least, whether any relation can be traced between the authors of this and of the mounds in Sacramento valley, yet occupied by existing tribes. In this connexion may also be mentioned a couple of modern fortifications erected by the Yakimas upon the Simkwe fork. They are situated between two small branches upon the summit of a narrow ridge, some two hundred yards long, and thirty feet in height, and are about twenty-five yards apart. The first is a square, with rounded corners, formed by an earthen embankment capped with stones, the interstices between which serve for loop-holes, and without any ditch. It is about thirty feet on the sides, and the wall three feet high. The other is built of adobes in the form of a rectangle, twenty by thirty-four feet, the walls three feet high and twelve to eighteen inches thick, with loop-holes six feet apart. Both are commanded within rifle-shot by neighboring hills. They were erected in 1847, by Skloo, as a defence against the Cayuses. We did not learn whether they were successfully maintained, accounts varying greatly on this subject. In the same neighborhood we noticed small piles of stones raised by the Indians on the edges of the basaltic walls which enclose these valleys, but were informed that they had no purpose—they were put up through idleness. Similar piles are, however, sometimes erected to mark the fork of a trail. At points on these walls there were also many graves, generally made in regular form, covered with loose stones to protect them from the cayotes, and marked by poles decorated with tin cups, powder-horns, and articles of dress. During the summer the Indians, for the most part, live in the small valleys lying well into the foot of the mountains. These are, however, uninhabitable during the winter, and they move farther down, or to more sheltered situations. The mission, which in summer is maintained in the Atahnam valley, is transferred into that of the main river. There are two priests attached to this mission, belonging to the order of the Oblats, Fathers Pandozy and d'Harbomey. The stations are small log buildings, divided into a chapel and lodging-room, with a corral for horses and a spot of enclosed garden ground adjoining the one at Atahnam. The fathers informed us that they found the Yakimas not very teachable, and that they had accomplished little except as peacemakers; the Indians were lazy and cultivated the ground with but little regularity, some years not planting at all. They did not believe that a resident farmer would be of use. The Indians, however, say, and justly, that they have no tools, and but little inducement to labor, their country affording other subsistence, and the toil of planting with their own rude implements not being compensated by the result. With proper encouragement, and assistance in breaking up the ground, they would doubtless do more. It is probably an object with the missionaries to discourage secular residents, who might divide their own influence over the natives.

The courteous attention of these gentlemen to the officers of the expedition requires acknowledgment. They furnished all the information in their power respecting the country, secured good guides to the parties, and acted as interpreters with the Indians. Father Pandozy, in particular, is familiarly acquainted with the Yakima tongue. Kam-ai-ya-kan is the only one of the three brothers who has adopted even the forms of Catholicism, and he refuses to be baptised, because he would be compelled to put away his surplus wives, of whom he has several. Skloo and Sha wa-wai are unchanged heathens.

On leaving the Klikatat country, Captain McClellan had made a small present to the chief Tow-e-toks, and distributed some tobacco among the men. It was not, however, considered necessary to enter into a formal talk with that tribe, the object of our visit, and some other points, being casually explained to them. With the Yakimas the case was different. Their country was to become a thoroughfare for the whites, and it was very important that a proper impression should be made, and a friendly understanding established. On leaving the mountains we first encountered Skloo, a tall, fine looking, but very dark-skinned man, who came up to camp attended by Wee-ni-nah, a sub-chief, living at the village of Skin, opposite the mouth of the Des Chutes river. We had already met with an amusing instance of Indian craft, in which Skloo proved to have been the operator. A small party of Indians had come on to Chequoss, and stated that they had been told the expedition was out for the purpose of seizing the horses and cattle of the Yakimas, taking their country, and destroying them if they resisted; that Lieutenant Saxton's party had proceeded against the Spokanes for the same purpose, and that Kam-ai-ya-kan and Skloo were determined to oppose us. The report had created no uneasiness, except lest it should alarm the Indians, and prevent the necessary intercourse with them. Skloo being now questioned as to the author of the report, stated that it was a Frenchman, in charge of the Hudson's Bay Company's train, who on his way to Fort Colville had preceded Lieutenant Saxton a few days. As the story had already caused us some inconvenience, in preventing us from obtaining a guide, and as it was feared that more serious annoyance would result to the other party, Captain McClellan forwarded a complaint on the subject to Governor Ogden, at Fort Vancouver. It subsequently appeared that the person referred to was a gentleman far above the suspicion of any such conduct, and that the whole was a fabrication got up by Skloo himself, for the purpose of fishing out the object of the expedition. A short talk was held with him by Captain McClellan, explaining this to his entire content, and in turn he gave what information he possessed respecting the mountain trails. In justice to him, it should be said, the more especially as he has but few friends, that his manly deportment left a more favorable impression than did some who bore a far better character. A small present was given him on parting.

Kam-ai-ya-kan we found at the mission, and he afterwards came over to the camp at Wenass for a formal visit. He is a large, gloomy-looking Indian, with a very long and strongly-marked face; slovenly in dress, but said to be generous and honest. Captain McClellan explained to him the general nature of the American government, as far as was necessary for him to understand, and the rank that Governor Stevens, who was coming with a party across the mountains, would hold in the country. He expressed the hope that the good disposition which Kam-ai-ya-kan had shown towards the whites would be maintained; that if any injury was done by them to his people, they were not to seek revenge, but complain to the Governor, who would redress it; and that if any was suffered from the Indians, he would expect him to punish the offender. It was the intention of the whites to make a wagon road across the mountains, and many would undoubtedly pass through their country. Should they be in need, he wished Kam-ai-ya-kan to assist them. Their coming would be an advantage to his people, for they would buy their potatoes, and exchange cattle which had become tired with long travel, for his, which were fat, giving him boot. In conclusion, he added that the great white chief had instructed him, when he met with friendly chiefs among the Indians, to give them a present as coming from him. A quantity of Indian goods were thereupon given him. Kam-ai-ya-kan made a suitable reply, in which he referred to a subject previously mentioned by Skloo—the negotiations of white men pretending to be chiefs, who were not, particularly in regard to the purchase of their lands. He had heard they would give a few presents, and then pretend they had purchased the land. Captain McClellan informed him who were the persons having the power to make these purchases, or to treat with them, with which he expressed himself satisfied.

At Ketetas, on the main Yakima, we were visited by Ow-hai, one of the two principal chiefs of the northern band of this tribe. His elder brother, Te-eh-yas, had gone to Puget sound, and we did not see him. Ow-hai appears to be forty-five or fifty years of age, and has a very pleasant face, with a high but retreating forehead, of which he is somewhat vain. In speaking of Kam ai-ya-kan, he remarked that he had a big head, and thought much; adding, as he touched his own, "like myself."

He remained with us during our stay, and afterwards accompanied the party as far as the Pisquouse. In a talk with him the same information was communicated, in substance, as that given to Kam ai-ya-kan. This band trades much more with the Sound than Kam-ai-ya-kan's, and is, therefore, better acquainted with trails; the one which proved on examination the best, leading directly up the river from our camp. After the usual custom of seeking wives in adjoining tribes, they are much intermingled with the Snoqualme on the western side of the Cascades, as well as the Pisquouse to the northward. The latter, in fact, speak indifferently the Yakima and their own languages. We found the people here much better dressed than those below. The young men and women affected more of their native costume than the old. Ow-hai's two sons, both tall, handsome men, had their blankets and dress profusely ornamented, and the wife of one of them, a very pretty woman, wore a dress stiff with bead-work and porcupine quills. Ow-hai himself, on the other hand, appeared in a full American suit, and touched his hat by way of salutation—a compliment which he clearly expected to be noticed and returned. He, like Kam-ai-ya-kan, has adopted some of the forms of Catholicism, and professes to pray habitually, but there seemed to be a shadow of hypocrisy in his devotion. He is, however, a man of very considerable understanding and policy, and inclined to profit by the example of the whites.

On striking the Columbia after passing the mountains, between the Yakima country and the Pisquouse, Ow-hai pointed out to us one of the lions of the country, in the shape of two columns of sandstone standing together, but apart from the bluff, which was of similar material. These, he told us, were "Ahn-cotté;" or, in the language of the fairy tales, "once upon a time" two women of the race of "Elip Tilicum," who lived here, and were very bad, being in the habit of killing those who passed by, the Indians begged the Great Spirit to destroy them, and He granting their prayer, sent an enormous bird which picked out their brains, and then turned them into stone. In proof of which, the narrator pointed out a hole in the top of one of the columns, from which a boulder had fallen, as the aperture broken by the bird in extracting his meal. A short distance beyond, he turned a little off the trail to point out to us another curiosity. It was a perpendicular rock, on the face of which were carved sundry figures, most of them intended for men. They were slightly sunk into the sandstone and colored, some black, others red, and traces of paint remained more or less distinctly on all of them. These also, according to their report, were the work of the ancient race; but from the soft nature of the rock, and the freshness of some of the paint, they were probably not of extreme antiquity.

Nothing could, in this connexion, be ascertained from the Indians, whether they had any traditions of their own migration from another country.

With the exception of the district occupied by the Flatbows and Kootenaies, the remaining country north of the forty-seventh parallel is occupied by different tribes of the *Selish* or *Flathead* nation. These may be divided for the present purpose into the following: the Pisquouse, Okinakane, Schwo-yelpi or Kettle Falls, Spokane, Cœur d'Alene, upper and lower Pend d'Oreilles, and Selish or Flathead proper.

The country of the Pisquouse lies immediately north of that of the Yakimas, and we entered it next upon our route. Under this appellation are here included the Indians on the Columbia between the Priest's and Ross rapids, on the Pisquouse or Winatshapam river, the En-te-at-kwu, Chelan lake, and the Methow or Barrier river. The name of Pisquouse, however, properly refers to a single locality on the river, known to the Yakimas as Winatshapam.

The Pisquouse themselves, as has before been remarked, are so much intermarried with the Yakimas that they have almost lost their nationality. These bands were formerly all united under one principal chief, Stal-koo-sum, who is said to have been a man of great note among them. He was killed a few years since in a fight with the Blackfeet, since when there has been no head of the tribe. Stal-koo-sum's son, Quil-tan-ei-nok, or Louis, was an aspirant for his father's throne, and came over to Ketetas to recommend himself to Captain McClellan's patronage, under the tuition of Ow-hai, who seemed to be interested in his promotion. It was considered desirable to unite the scattered fragments of the empire under one head, if possible, and he was therefore engaged as a guide, the better to ascertain his character. It should be remarked, that though the chiefdom of the petty bands, or villages, seems to be hereditary, it does not always follow that one who has placed himself at the head of the tribe, or confederacy, transmits his power. Quil-tan-ei-nok had, as we learned, used great efforts to succeed in this object of his ambition; having gone to the Sound, and even to the Willamette valley, to procure a paper from some agent recognising his rights, on the strength of which he might silence all cavillers. In this he had been hitherto unsuccessful, and he was doomed to further disappointment. On reaching the mouth of the Pisquouse, Captain McClellan informed the Indians that it would be well for them to choose, in concert with their neighbors, a head chief, who would represent them all, and who might talk for them with the chief of the whites; that if they would agree among themselves upon a proper person, the Governor would give him a great writing, signifying his consent. In the mean time some presents were distributed; that to Quil-tan-ei-nok being the largest, that he might have honor among his own people at least. When the election came off, however, he was beaten, and by a candidate whose name had never previously been mentioned. At this place we were offered the entertainment of a horse-race, and on promising a yard of red cloth as the prize of victory, a general enthusiasm seized upon the whole tribe. Horses were sought in every direction, that would stand a chance of winning, and in a short time a dozen of the best came up to the starting-point. A goal was fixed on the plain, at some distance, which they were to turn around and return; and at a signal from the chief they stripped—not the horses, but the riders; doffing their blankets and other inconvenient articles, and appearing in costumes of primitive simplicity. One rider wore a pair of moccasins, and another sported a shirt; while with a third a streak or two of red paint, judiciously disposed, gave every requisite distinction. There was some very pretty running, and still better jockeying; but as the distance was unmeasured, and nobody took note of the time, an official report cannot be given. The winner, who rode a handsome gray gelding, carried off a prize that a few years before was worth as much as his horse.

The Okinakanes comprise the bands lying on the river of that name as far north as the foot of the Great lake. They are six in number, viz: the T'Kwuratum, at the mouth; Konekonl'p, on the creek of that name; Kluckhaitkwu, at the falls; Kinakanes, near the forks; and Milakitekwa, on the west fork. With them may be classed the N'pockle, or Sans Puelles, on the Columbia river; though these are also claimed by the Spokanes. The two bands on the forks are more nearly connected with the Schwoyelpi than with the ones first named. The country of the Pisquouse and Okinakanes may be described together, and briefly. It is mountainous and sterile, the valleys narrow, and affording here and there spots susceptible of cultivation. For grazing it is as little adapted; and there is, in its whole extent, nothing to tempt encroachment upon its miserable owners.

During Captain McClellan's examination of the Methow river, six of the bands, belonging in part to each tribe, agreed upon Ke-keh-tum-nouse, or Pierre, an Indian from Klahum, the site of Astor's old fort, at the mouth of the Okinakane, as their chief.

The occasion furnished an opportunity of making an actual count, which for these six bands gave a total of 274. The remainder would, according to our observations, raise the number of Indians south of the 49th degree, and between the Columbia and the Cascade mountains, to 550; a larger one than was expected. As the smallpox was at its height, however, this is doubtless already much diminished. During the whole route we found the disease prevailing to a fearful extent. Several villages had been nearly cut off; and we saw, at some places, the dead left unburied on the surface of the ground. These tribes have no cattle, and but comparatively few horses. They told us that formerly they had many, but that the company had purchased them for food; and they complained bitterly that the shirts and other articles given them in exchange were worn out, and nothing was left them but their new religion. At Fort Okinakane we observed a mode of disposing of the dead differing from any before noticed. They were wrapped in their blankets, or other clothing, and bound up right to the trunk of a tree, at a sufficient distance from the ground to preserve them from wild animals. Notwithstanding the climate, none of these Indians have a better shelter than is furnished by their mats. They raise some potatoes, but their main resource is salmon. These, at the time of their visit, actually filled the streams. In the Okinakane, in particular, there were myriads of a small species, which had assumed a uniform red color. They were depositing their spawn, and were in a condition eatable only by Indians, who were busily engaged in drying them.

On leaving Fort Okinakane, the new chief accompanied the party to Fort Colville in the capacity of a guide, assisted by two of his subjects; and the cavalcade was enlarged at the lake by the chief of the Saht-lil-kwu band, a religious personage, who sported the title of King George, and persecuted us nightly with family worship. We parted with the whole with the loss of much tobacco and few regrets. Fort Colville is the principal ground of the Schwoyelpi, or Kettle Falls tribe, one of the largest of the Selish.

According to the information received from Father Joset, of the Jesuit mission, they number from five to six hundred. At the time of our visit the greater part had gone to the buffalo hunt. They do not obtain many furs, the greater part of those taken at this post coming from the upper Columbia. The fishery at the Kettle falls is one of the most important on the river; and the arrangements of the Indians, in the shape of drying-scaffolds and stone houses, are on a corresponding scale. They take the fish by suspending immense baskets upon poles beneath the traps, into which the salmon spring. We saw here, for the first time, the canoe used upon the upper waters of the Columbia. It is of birch bark, and of a form peculiar to these rivers, being longer on the bottom than on the top. A canoe, of thirty feet in length on the floor, is open only about twenty-four feet, and gathered to a point about three feet long at each end. They are stretched on a light frame of split twigs, and are at once fast and buoyant. The mission is situated upon a high bluff above the falls, and consists of a small house for the priest and a chapel. Around these are a number of huts and store-houses belonging to the Indians; the latter raised from the ground on posts. Fathers Louis and Joset, of the Order of Jesuits, are stationed here. Our visit admitted of but little opportunity of gathering further information concerning the Indians than what has already been published. The few who were present were assembled by Governor Stevens, who addressed them. They have no head chief of note, and there were present on the occasion only Klekahkahi, the chief at the falls; Kuiltkuiltlouis, a sub-chief; and Elimiklka, the son of a former chief of this place.

The last was highly spoken of by Mr. McDonald, but did not seem to be in equal favor at the mission. We learned that but few of the original Schwoyelpi stock remained; they had gradually become extinct, and their places were filled by people from the adjoining bands. The smallpox had as yet made no great inroads on this band; its general course seemingly having been up the eastern side of the Columbia. One case had, however, occurred at the time of our arrival. On the route from Fort Colville to Wallah-Wallah the party passed the old Chemakane mission, the former station of Messrs. Walker and Eels. The house was still standing, and occupied by an American. This is the country of the Spokanes, who are next to be noticed.

The Spokehnish, or Spokanes, lie south of the Schwoyelpi, and chiefly upon or near the Spokane river. The name applied by the whites to a number of small bands, is that given by the Cœur d'Alenes to the one living at the forks. They are also called Sinkoman by the Kootenaies. These bands are eight in number: the Sin-slik-hoo-ish, on the great plain above the crossings of the Cœur d'Alene river; the Sintootoolish, on the river above the forks; the Sma-hoo-men-a-ish, (Spokenish,) at the forks; the Skai-schil-t'nish, at the old Chemakane mission; the Ske-chei-a-mouse, above them on the Colville trail; the Schu-el-stish; the Sin-poil-schne, and Sin-spee-lish, on the Columbia river; the last-named band is nearly extinct. The Sin-poil-schne (N'pochele, or Sans Puelles) have already been included among the Okinakanes, though, as well as the Sin-spee-lish below them, they are claimed by the Spokanes. The three bands on the Columbia all speak a different language from the rest. Most of the Indians, at the time of our visit, were absent on their hunt, and we had no opportunities of estimating their number by inspection. Judging from those that we saw, and the information received from various sources, they probably amount, excluding those enumerated at Okinakane, to four hundred and fifty. They were a wilder-looking race than the tribes to the westward. The men are generally spare, even when young, and soon become withered.

Their principal chief is Spokane Garry, whose name was bestowed upon him by Governor Sir George Simpson, by whom he was sent, when about twelve years old, to the Red river for education, where he spent five years. Garry is now about forty-two years of age, is very intelligent, and speaks English fluently. He bears an excellent character, and is what he claims to be, and what few are among these tribes, a *chief*. Of petty chiefs there are, besides, an abundance, each band having two or three. Garry himself accompanied us to the forks of the Spokane, where his band usually reside. A few lodges, chiefly of old men and women, were there at the time. His own, in neatness and comfort, was far beyond any we had seen. His family were dressed in the costume of the whites, which in fact now prevails over their own. Many of the Spokanes, besides their intercourse with the fort, visit the American settlements, where they earn money by occasional work, most of which is spent in clothing, blankets, &c. The chief offered us the hospitality of his house with much cordiality—a cup of tea or coffee and bread. The "Spokane House," which is a landmark upon all the maps of this country, was an old Hudson's Bay fort, situated at his village, but has long since been destroyed.

This tribe claim as their territory the country commencing on the large plain at the head of the Slawntehus—the stream entering the Columbia at Fort Colville; thence down the Spokane to the Columbia, down the Columbia half-way to Fort Okinakane, and up the Spokane and Cœur d'Alene, to some point between the falls and the lake, on the latter. There is in this direction a question of boundary between them and the Cœur d'Alenes, which appears to be as complicated as some of those between more civilized nations. No resort to arms has, however, occurred, and the territory continues under joint occupation. An additional source of coolness between them arises from a difference in religion—the Spokanes being Protestants, or of the "American religion," and the Cœur d'Alenes Catholics. The latter taunt the former as heretics, whose faith is worthless. Garry narrated to us the evils arising from this state of feeling, with a forbearance and Christian spirit of toleration which would have honored any one. This tribe have at present no missionary among them, but they seem to have been consistent to what they learned under the tuition of Messrs. Walker and Eels, of the Chemakane mission. The country of the Spokanes, though in most respects unattractive to settlement by the whites, is well suited to the pursuits of the Indian.

The high plain, which extends from the Spokane river to Lewis's fork of the Columbia, and which belongs chiefly to them and the Nez Perces, though bleak and exposed to violent winds, affords grazing for their stock and an abundance of the roots used by themselves for food, while their river supplies them with salmon. They obtain buffalo hides for their lodges, and skins of elk, carraboo, and deer, for their own clothing, in their semi-annual hunts to the eastward.

Of the larger game there is but little in their own country. The buffalo, it would seem, in former times penetrated at least occasionally thus far to the westward, though now they never come through the northern passes. We were informed by an old Iroquois hunter at Fort Colville, who has been some forty-eight years in the company's service, that the last bull was killed some twenty-five years ago in the Grand Coulée.

Of the remaining tribes of the nation it will be necessary to speak even more briefly, for our journey did not bring us in contact with them, and but little can be added to what has been before published.

The Skitswish, or Cœur d'Alenes, live upon the upper part of the Cœur d'Alene river, above the Spokanes, and around the lake of the same name. They are estimated by Dr. Dart as only two hundred in number, which is believed, however, to be too low an estimate. Father Mengarini, formerly missionary among the Flatheads, gives as his opinion that they reach four hundred and fifty. A mean has been adopted in the recapitulation. This tribe has also a missionary station belonging to the Order of Jesuits.

The Kalispelms, or Pend d'Oreilles of the Lower Lake, inhabit the country north of the Cœur d'Alenes and around the Kalispelm lake. Dr. Dart gives their population as five hundred and twenty, which is but little short of Father Mengarini's.

The Slka-tkml-schi, or Pend d'Oreilles of the Upper Lake, a tribe who, by the consent of the Selish, occupy jointly with them the country of the latter. According to the same authorities, they reach about four hundred and eighty.

The Selish proper, or Flatheads, inhabit St. Mary's or the Flathead valley, and the neighborhood of the lake of the same name. Mr. John Owen, who occupies the site of the old Jesuit mission of St. Mary's as a trading-post, says that there remain of these but sixty-five lodges, of about five to a lodge, giving a total of three hundred and twenty-five—a number considerably exceeding Dr. Dart's estimate, which is but two hundred and ten.

The tribe was once a very powerful one, but has been much diminished by the attacks of the Blackfeet, who enter into their country through the mountain passes, or meet them in their hunts upon the eastern side.

Their custom is to make two hunts annually across the mountains—one in April, for the bulls, from which they return in June and July; and another, after about a month's recruit, to kill cows, which have by that time become fat. In these excursions they are accompanied by that portion of the Pend d'Oreilles who live in their country, and about one hundred lodges of the Nez Perces, as well as parties from such other tribes as see fit to join them. Their country is admirably adapted for grazing, and they possess about one thousand head of American cattle, which were introduced by the worthy and zealous Father De Smet.

They are not rich in horses, but still have many good ones, though frequently robbed by their enemies, the Blackfeet. They get no salmon, but live altogether by the hunt, and do not manifest any disposition to agricultural pursuits or fixed residence. They have no canoes, but in ferrying streams use their lodge skins, which are drawn up into an oval form by cords, and stretched on a few twigs. These they tow with horses, riding sometimes three abreast. Their own territory still furnishes them with ordinary kinds of game—elk, moose, black and white-tailed deer, the bighorn, and bears. Beaver and otter are abundant.

The mission of St. Mary's was abandoned in 1850, the habits of the Flatheads leaving the missionaries unprotected, and proving an obstacle to effectual labor. They have at the station a village of log-houses, but notwithstanding generally prefer their own lodges. Their great chief is Kwi-kwi-kal-sih, or Victor, a man highly spoken of by the whites who have come in contact with him. The tribe, in fact, seem to be an exception among the Indians of Oregon. Their heroism in battle, their good faith towards others, and their generally inoffensive conduct, have been the theme of praise both from priest and layman. They are, however, rapidly disappearing before the murderous warfare of the Blackfeet. Should their country become a thoroughfare of travel, they will, to some degree at least, be protected from their enemies; but, on the other hand, the destruction of the buffalo and other game will render some new mode of subsistence an object of proper care on the part of the government.

The Kootenaies or Kitunahas, and the Flatbows, who now, according to Father De Smet, form one tribe, called by their neighbors Skalza, or Skolsa, inhabit the country extending along the foot of the Rocky mountains, north of the Flatheads, for a very considerable distance, and are about equally in American and in British territory. They do not enter into the census of the Oregon superintendent, and they have had no intercourse with the whites except through the Fur Company. Captain Wilkes states their number at about 400. Their usual camp is situated in the Tobacco plains, where they were visited in 1845 by Father De Smet, who gives a description of their country.

The Nez Perces, or Saptin, lie to the south of the Selish, and on both sides of the Kooskooskia and north fork of Snake river.

Their country, like that of the Wallah-Wallahs, extends into both Oregon and Washington Territories. They are one of the most numerous of all these tribes, amounting, according to the census of 1851, to 1,880; since when there has probably been less decrease than among some of the others.

They are much intermarried with the Wallah-Wallahs, whose language belongs to the same family, and also with the Cayuses. They have no chief of note at present living; Towwattu, or the "Young Chief," having recently died.

Wailatpu, or Cayuse: The country belonging to this tribe is to the south of and between the Nez Perces and Wallah-Wallahs, extending from the Des Chutes or Wawanui river to the eastern side of the Blue mountains. It is almost entirely in Oregon, a small part only, upon the upper Wallah-Wallah river, lying within Washington Territory. The tribe, though still dreaded by their neighbors, from their courage and warlike spirit, is but a small one, numbering, according to the same authority, 126. Of these, individuals of the pure blood are very few; the majority being intermixed with the Nez Perces and Wallah-Wallahs—particularly with the former—to such a degree that their own language has fallen into disuse.

It was this tribe that destroyed Dr. Whitman's mission in 1847. Their head chief, Pa, or the "Five Crows," has since then generally absented himself from his people, as, although not concerned in the murder, he became notorious for the abduction of one of the women. These are all the tribes which enter into the Territory east of the mountains, except that a small remnant of the original tribe belonging at the Cascades of the Columbia river still exist. They are of the Upper Chinook nation. From their geographical situation, they will fall within the eastern district; and as the Klikatats frequent the fishery there, it would be desirable to comprehend them with the latter.

It would be interesting to give a reliable comparison of the Indian population at the different periods since their intercourse with the whites; but the data from which this could be drawn are too uncertain to furnish satisfactory conclusions. Messrs. Lewis and Clark give the earliest information respecting them.

Their journey, however, permitted only very loose conjectures on the subject, and their division of the tribes is with difficulty to be recognised at present. The following, however, appears to be the arrangement, and it is so far intelligible as to render it certain that their locations have not materially changed within that time.

Lewis and Clark's Estimate—1806 *and* 1807.

Names of Tribes.	Corresponding names.	Population.
Wallah-Wallah	Wallah-Wallah	2,600
Wah-how-pum	John Day's river	1,000
E-ne-show	Des Chutes river	1,200
Se-wat-palla	Peluse	3,000
Sokulk	Priest's Rapids	3,000
Chan-wap-pan	Lower Yakima	400
Shal-tat-tos	do	200
Squam-a-ross	do	240
Skad-dals	do	400
Chim-nah-pun	Upper Yakima	2,000
Sha-la-la	Cascades, Upper Chenooks	1,000
E-che-loot	do do	1,000
Chilluk-kit-e-quaw	Dalles	2,400
Smak-shop	do	200
Cat-sa-nim	Okin-a-kanes	2,400
He-high-e-nim-mo	Sans Puelles	1,500
Whe-el-po	Schwo-yel-pi	3,500
Sar-lis-lo	Spokanes	900
Sket-so-mish	do	2,600
Mick-suck-seal-tom	Pend d'Oreilles	300
Ho-pil-po	Flatheads	600
Tush-e-pah	Koo-tames	800
Chopunnish	Nez Perces	8,000
Wille-wah	Grand Ronde	1,000
Willet-poa	Wai-lat-pu	
Total population		42,200

Captain Wilkes's Estimate—1841.

Names of Tribes.	Population.
Cascades	150
Dalles	250
Yakima	100
Okinakane	300
Colville and Spokane	450
Des Chutes, &c	300
Wallah-Wallah	1,100
Total population	2,650

The above furnishes a very incorrect statement even of the tribes that are given, and some of the most important are omitted altogether. No conclusion can be drawn from it whatever. A more general one is contained in Captain Wilkes's pamphlet on Western America, as follows:

Names of Tribes.	Population.
Kitunana	400
Flatheads	3,000
Nez Perces	2,000
Wallah-Wallahs	2,200
Total population	7,600

Which is also much less than the actual number at that time. Yet more incorrect is the estimate of Lieutenants Warre and Vavasour, R. N., published in Martin's "Hudson's Bay Territories, &c.," in 1849, though, as regards this part of the Territory, it is not so bad as the rest:

Estimate of Lieutenants Warre and Vavasour.

Names of Tribes.	Population.
Wallah-Wallahs, Nez Perces, Snakes, &c	3,000
Colville and Spokane	450
Okinakane, several tribes	300
Kullas Palus, (Kalispelm,) several tribes	300
Kootenaies, several tribes	450
Total population	4,500

Dr. Dart's Estimate—1851.

Names of Tribes.	Men.	Women.	Children.	Total.
Wallah-Wallah	52	40	38	130
Des Chutes	95	115	90	300
Dalles	129	206	147	482
Peluse	60	62	59	181
Knnatat	297	195		492
Yakima, (estimate)				1,000
Rock Island				300
Okinakane				250
Colville				320
Sin-ha-ma-miah, (Spokane)				232
Cœur d'Alene				200
Lower Pend d'Oreille				520
Upper Pend d'Oreille				480
Mission				210
Nez Perces	698	1,182		1,880
Cayuse	38	48	40	126
* Total population				7,103

* The Pisquouse and Kootenaies are omitted, and the band of Upper Chinooks, at the Dalles, included with the Wallah-Wallahs.

Estimate of 1853.

Names of Tribes, &c.	Population.
Klikatats	300
Yakimas	600
Pisquouse and Okinakanes	550
Schwoyelpi, or Colville	500
Spokane	450
Cœur d'Alene	325
Lower Pend d'Oreille	480
Upper Pend d'Oreille	520
Flatheads	325
Kootenaies and Flatbows	400
Nez Perces	1,700
Cayuse	120
Wallah-Wallahs, Peluse, &c	500
Dalles bands	200
Cascades	36
Total population	7,006

NOTE.—Of which it is proposed that the Nez Perces, Cayuse, Wallah-Wallahs, and Dalles Indians remain under the Oregon superintendency.

As the relations of the Hudson's Bay Company to the Indian tribes, as well as to the citizens of the Territory, is a matter of some importance, a statement of their establishments is herewith submitted.

The principal is Fort Vancouver, on the Columbia river, which is the parent establishment whence the others are supplied with goods. The post is enclosed by a stockade of two hundred by one hundred and seventy-five yards, twelve feet in height, and is defended by bastions on the northwest and southeast angles mounted with cannon. Within are the governor's house, two smaller buildings used by clerks, a range of dwellings for families, and five large two-story ward-houses, besides offices. Without, there is another large store-house, at present hired by the United States. These are all built of square logs framed together. At some little distance there is also a village of fifty or sixty cabins, occupied by servants, Kanakas, and Indians, and a salmon-house on the bank of the river. The buildings are old and considerably decayed, only the repairs necessary to keep them in tenantable order having of late years been expended. There are at present two chief factors at this post, Messrs. Peter Skene Ogden and Donald MacTavish, with a considerable number of clerks and other employés.

The company's land claim at Fort Vancouver embraces several tracts: first, the plain on which the fort and United States barracks are situated, with a small one behind it, making together a tract of about four miles square. About one thousand acres are enclosed or under cultivation; attached to which there are sheds, stabling, and a small dwelling for a farmer. Adjoining this, to the eastward, is another tract, known as the Mill claim, two and a half by three-quarter miles square, on which is a saw-mill having tolerable water-power, but subject to stoppage during freshets. Besides the above, they claim two other small prairies behind the first mentioned, which are respectively a half and one mile square.

The business at this post has changed with the condition of the country since the treaty, and is now almost entirely mercantile and carried on with the settlers. American Oregon never was, strictly speaking, a fur country, and the fall in the value of beaver has annihilated what trade it once afforded. Comparatively a small amount of Indian goods are now imported, that description of merchandise being sent to the posts in their own territory by way of Victoria. What trade with Indians is carried on here is the ordinary retail trade of country stores, and for cash. The amount of their general business may be gathered from their imports during 1853. These consisted of one cargo of assorted American goods from New York, and another valued at about £19,000 from London, paying duties to the amount of nearly $24,000. A considerable portion of these were sold on commission at Portland, Oregon City, and other places in the Willamette valley.

The next post above Vancouver is Fort Wallah-Wallah, on the Columbia river, below the entrance of the Snake. There are here three or four one-story adobe buildings, with offices, enclosed by a wall of the same material some thirty-five yards on each side, having a bastion at one angle. It is almost utterly valueless except as a station where horses can be kept for the trains. There is, indeed, some trade with the neighboring Indians, chiefly in cash, but not enough to warrant its maintenance, except for the above purpose. The fort is in very indifferent repair, and the country in the immediate neighborhood a desert of drifting sand. Some eighteen or twenty miles up the Wallah-Wallah river is a so-called farm, on which are two small buildings, a dwelling-house, and dairy. There was formerly a dam for irrigation, but it is broken down. They have here some twenty acres cultivated in different spots; the principal object is grazing. The force here consists of Mr. Pambrun, chief clerk, one interpreter, two traders, and six men, Canadians and Indians.

Fort Colville, upon the Columbia, above Kettle falls, is next in importance to Vancouver, though far inferior to it in extent. It is situated on the second terrace, at some distance back from the river, the lower one being flooded in part during the freshets. The buildings consist of a dwelling, three or four store-houses, and some smaller ones used as a blacksmith's shop, &c.;

all of one story, and built of square logs. The whole was once surrounded by a stockade, forming a square of about seventy yards on each side. This had been removed, except on the north, where it encloses a narrow yard containing offices. One bastion remains. About thirty yards in the rear of this square are the cattle-yard, hay-sheds, &c., enclosing a space of forty by sixty yards, roughly fenced in, and the sheds covered with bark. On the left of the front are seven huts, occupied by the lower employés of the company; they are of rude construction and much decayed. On the right of the square, in the rear, at a distance of a few hundred yards, are three more buildings, used for storing produce.

Besides the principal establishment, there is a cattle-post, about nine miles distant, on the stream laid down as the Slawntehus, and a grist-mill of one pair of stones, three miles off, on the same stream. The latter is said to be in pretty good order, and the water to serve all the year round. Here, formerly, the flour for the northern posts was ground from wheat raised on the company's farm. This farm was once pretty extensive, but only a small portion is cultivated at present.

Fort Colville was once the post of a chief factor, the highest officer in charge of a station, and here the annual accounts of the whole country were consolidated previous to transmission across the mountains. The present force consists only of Mr. McDonald, chief clerk, a trader, and about twenty Canadians and Iroquois Indians. In former years goods were sent through this post to those north of the line, but this route is now abandoned. The amount of furs collected here is not large, and comes chiefly from the upper Columbia. They are principally bear, beaver, muskrat, marten, and fox skins. The beaver is not considered to be worth in London more than its cost when laid down there.

About fifteen Canadians are settled on claims in this neighborhood, chiefly on the Slawntehus. They are former servants of the company whose time has expired, and who intend to be naturalized.

Below Fort Colville is Fort Okinakane, situated on a level plain on the right bank of the Columbia, a little above the mouth of the Okinakane river, and not far from the site of one of Mr. Astor's posts. The fort consists of three small houses, enclosed with a stockade. There were formerly some outbuildings, but they have been suffered to decay. There is no appearance of business here, and no goods on hand. One trader, a Canadian, was the only white man on the ground when we visited it. A few furs only are taken, and the post probably does not pay its expenses. It was once of consequence as a stopping place for the bateaux passing to and from Fort Colville, but is now kept up apparently for form's sake. We learned that the price of such furs as were taken here was, for a black fox-skin, a quarter of a yard of red cloth, or a red cock-tail plume; for marten or red fox, ten charges of powder and ball; for beaver, otter, or bear skins, thirty charges.

Fort Koutamie, upon the great bend of the Flatbow river, and not far from the Flathead lake, is an inferior post, in charge of a Canadian as trader and postmaster, with one Canadian and a half-breed under him.

The above constitutes all the posts situated in the country east of the Cascades and north of 46°. It may be worth while to include the rest of those in American territory.

There are in Oregon and east of the mountains only two—Fort Hall, on the head of the Snake river; and Fort Boisée upon the same, nearly opposite the mouth of the Owy-hee. The latter is merely a stopping place, occupied by a trader and a few Kanakas. The former is a more important one, from its opportunities for trade with the emigrants and with the Salt lake. Of the present condition of this I am not informed; but it is only a third-rate post.

West of the Cascades, in Oregon Territory, the principal is Fort Umpqua, on the Umpqua river. This was destroyed by fire two or three years since; but to what extent, since rebuilt, I do not know. The rest consist of a house and granary at Champoes, on the Willamette; one acre of ground below the falls of Oregon City, purchased from an American, a farmer; 640 acres on Souvies's island, at the mouth of the Willamette; with a house, dairy, and garden—the building about six years old. The old buildings at Astoria are of no value whatever.

In Washington Territory, west of the Cascades, there are, first, and the only one of importance, Fort Nisqually, on the lands of the Puget Sound Agricultural Company. It is situated at some distance from the water, on a high, undulating prairie, and is a cluster of small buildings, of no great value, within a stockade. The trade here is principally with the settlers. Besides this, there is a granary and about five acres of land two miles above the mouth of the Cowlitz river; a tract of land on Cape Disappointment, occupied by an old servant, and a small store and lot of ground at Chinook.

With the exception of Fort Vancouver, it is believed that none of these posts are worth maintaining for any other purpose than that of holding the property till a sale can be effected. The condition of the whole country is completely changed since they were established, and the company are now little else than general merchants. At all points of present importance they meet with the usual competition from our citizens; and whenever it will repay the enterprise, the same competition will follow them elsewhere. The relations of the company to the Indians are necessarily far less intimate than they have been, though not less friendly; but even the more distant tribes now frequent the towns, attracted partly by novelty, and partly by the opportunities afforded for earning money by labor. Most of them comprehend fully that the sceptre has departed from Judah, and that our own people possess the country.

The familiarity of the company's officers with the Indians and their usages, of course gives them a certain influence; but there is no evidence that this has been used unfairly, or that since the conclusion of the treaty they have ever endeavored to prejudice them against our government. So far as regards their course previous to that time, it was clear enough. As traders, they endeavored to secure to themselves every advantage of trade; as British subjects, they upheld and stood by their country while it stood by them; but in every matter between a white man and an Indian, they sustained the white, of whatever nation. The conduct of Dr. John McLoughlin and of Mr. Peter Skene Ogden, on more than one trying occasion, was worthy of all praise. It was the former who, on the destruction by the Umpqua Indians of the train under the command of Jedediah Smith, an American and a rival fur-trader, sent against the aggressors an armed party, and restored to him, without charge, his recaptured goods; it was the latter who, upon hearing of the Whitman massacre, instantly set out himself for the Cayuse country and purchased the liberty of the surviving women and children. For the expenditure on this occasion, it may be mentioned, the company have never requested or received payment. Their hospitality and kindness to the early settlers drew upon them censure from home; while, in this country, those who have received most at their hands have been most bitter in their abuse.

The white servants of the company, as their time expires, settle here and become naturalized. Some of the officers, also, are already citizens, and others will follow their example. Very few will ever leave the country.

In respect to the impression which it is supposed may be created by purchasing goods from them for Indian service, it may be remarked, that any danger or misconception of this point has passed away. Very few goods have, in fact, ever been purchased from the company by government officers for this purpose, and the reason, on those occasions, has been simply because they alone had supplies of suitable kind.

The missions also require notice in connexion with Indian relations.

The Presbyterians formerly had stations among the Cayuse at Waiatpu, on the Wallah-Wallah river, under the superintendence of Dr. Whitman; among the Spokanes at Chemakane, upon a branch of the Spokane river, under Messrs. Walker and Eels; among the Nez Perces at Lapwai, near the mouth of the Kooskooskia, under Mr. Spalding; and at Kaima, on its headwaters, under Mr. Smith. The last was maintained but a short time, and all of them have been abandoned since Dr. Whitman's murder. The Methodists also once had a mission at the Dalles.

The only missions now among the eastern tribes are those of the Jesuits and Oblats. There are, of the former, two priests at Fort Colville, two among the Pend d'Oreilles and two among the Cœur d'Alenes. Of the latter, there is one at Wailatpu, and two on the Yakima. The mission of St. Mary's, among the Flatheads, was given up in 1851, on account of the Blackfeet incursions. The Yakima mission is not fixed, but transitory, having two regular stations, one occupied in winter, the other in the summer.

Concerning the influence of the existing missions, there can be no doubt that it is, to a certain extent, beneficial in preserving peace among the tribes, as well as in settling private quarrels. Beyond a very small number, however, their control over individuals is limited. They have, unquestionably, inculcated principles of honesty and morality, which in some cases perhaps have taken root, but have essentially failed in accomplishing any great and lasting improvement. Many of the Indians have adopted certain forms of Christianity, such as the sign of the cross, the repetition of short prayers, or singing of canticles; but I have failed to notice that this has always been a proof of trustworthiness. For the rest, it is evident that the objects of these gentlemen are inconsistent with the settlement of the country, or the establishment of fixed agencies. It is not intended to be represented that they have used reprehensible means; but in the knowledge that their influence must infallibly be shaken whenever contact with the whites becomes general, it is not to be doubted that they have discouraged it.

In this connexion it may be remarked, that under no consideration should agencies be conferred on priests or clergymen of any denomination, as the desire to propagate their own peculiar tenets cannot fail to embarrass their official relations. The distinction is already drawn among the Indians between the "American" and French religions, and, as in the case of the Cœur d'Alenes and Spokanes, has already created ill feelings. Any appointments of clerical officers will necessarily be regarded as an endorsement of their peculiar doctrines; whereas all idea of a connexion of religion and government should be discountenanced.

It is a fortunate circumstance that there has as yet been little or no negotiation with the Indians of the Territory, and that their official relations with the government have been but few, and those confined to tribes on the Columbia river. The evils arising from the want of a settled and consistent policy, from constant changes of agents, and from the rejection of treaties entered into with them, have not arisen here. The field is new, and it is highly desirable, both for the sake of the whites and the Indians, that it should be entered upon with judgment.

To remove the Indians altogether into any one district is impracticable, for the western verge has been reached. To throw the fishing tribes of the coast back upon the interior, even were the measure possible, would destroy them; nor is there any suitable region east of the Cascades where all of the tribes now living there could be concentrated and find food. They must, therefore, remain as they are, adopting such a plan only as will remedy, so far as may be, the inconvenience of the contact.

The great primary source of evil in Oregon and the western part of this Territory is the donation act, in which, contrary to established usage and to natural right, the United States assumed to grant, absolutely, the land of the Indians without previous purchase from them. It followed, as a necessary consequence, that as settlers poured in, the Indians were unceremoniously thrust from their homes and driven forth to shift for themselves. No provision was made to support them after their former means were taken away; and finally the treaties negotiated by authorized agents of the government, in which some small patches of their own territories were secured to them, were either rejected or passed over in silence. A consequence of this has been that a natural distrust has sprung up in their minds as to the good faith of the government or its agents in making treaties at all. The policy has indeed one merit, that of economy. But a few years will elapse before a universal escheat will preclude the necessity of any purchase.

Excepting a few persons south of the Columbia and Snake rivers, and the Hudson's Bay Company's forts, there are few or no white settlers within the limits of Washington Territory east of the Cascades. So far, therefore, as the tribes inhabiting that country are concerned, no difficulty has as yet sprung up. It is entirely in the power of the government to obviate its future occurrence.

But in order to avoid the rejection of future treaties, a course almost impossible to explain satisfactorily, and which is rendered still more unfortunate by the length of time required to amend or renew them, it is necessary to procure in advance from Congress some expression of its views on the subject. This is in fact requisite under any circumstances, because the law gives no power to the superintendent to make even provisional reserves, and lands set aside for Indian use may be taken up without remedy before a satisfaction can be procured. In fact, they are very likely to be so, with a view to speculation out of the government.

It is not believed that extensive reserves would be desirable for these tribes. The nature of their country and their own habits make the case entirely different from those of the prairie Indians. Although some of them cross the mountains in search of buffalo, they are not generally hunters; nor is their country any longer a game country. They require the liberty of motion for the purpose of seeking, in their proper season, roots, berries, and fish, where those articles can be found, and of grazing their horses and cattle at large; but they do not need the exclusive use of any considerable districts. A large portion of their territory will, in all human probability, never be occupied by white men; and so far nature has provided reserves. What is necessary for them, and just in itself, is, that small tracts of good land should be set apart as permanent abodes, where they may raise their vegetables and bury their dead, secure that they will not be driven off at the pleasure of the first comer.

This is especially so, because their main resource during a portion of the year is speedily destroyed in the neighborhood of settlements. A drove of hogs belonging to one white man will consume the winter provision of a tribe of Indians. In like manner, the use of their customary fisheries, and free pasturage for their stock on unenclosed lands, should be secured.

The subject of the right of fishery, in its present position, is believed to be one concerning which difficulties may arise. It is certain that the intention of Congress never was that the Indians should be excluded from them; but as no condition to this effect was inserted in the donation act, the question has been started whether persons taking claims, including such fisheries, do not possess the right of monopolizing them. It is, therefore, proper that this also should be set at rest by law.

A tract of a mile square would, it is believed, be sufficient for each of the before-mentioned tribes, or, where deemed more convenient, four quarter-sections at different points. This amount, however, should not include the land required for agencies; and authority ought to be given to the superintendent to set aside for this purpose not exceeding another square mile, (to be in one body,) in the territory of each tribe, which shall be exempted from individual claim. It is not supposed that it will be requisite to occupy them all at once; but, in anticipation of the future settlement of the country, it is desirable to secure suitable positions, that the United States may not be compelled to buy back what is required for public uses.

No conventional arrangements, strictly so speaking, are known which need action on the part of the government; but the assurance has everywhere been given by the whites, settling among the Indian tribes, that Congress would compensate them for the lands taken. Those among whom establishments have been made for any length of time, finding themselves crowded out of their houses, and fast dwindling away, ask often when this promise will be fulfilled, for they have but a little time left to employ it, and they leave no children behind. Distrust thus attaches to the country, and the advance of settlement into new districts is looked upon with suspicion.

As regards treaties for the purchase of their lands and other purposes, it would be most advantageous simply to acquire the right of settlement at pleasure in their territory, except upon the tracts reserved for their own use, leaving the remainder as lands common to both. Payment should be made to them in goods, for although most of them understand the value of money perfectly, the former mode is preferable, as it does not furnish an inducement to go into the towns, and as it confers a greater benefit at less cost. The merchandise should consist chiefly of blankets, coarse warm clothing, agricultural tools, &c., with as few of what is termed "Indian goods" as possible. In respect to presents, the indiscriminate distribution of considerable amounts is to be avoided as useless if not injurious. Small presents are proper on the occasional visits of chiefs to the agencies, but these should be discouraged when not on business.

In negotiating treaties, as the distance from the settlements to the residences of the different tribes is very considerable, and the cost of transporting merchandise for presents to the interior would be enormous, it is recommended that none whatever be given, with the exception of a little tobacco for the council smoke, and on the conclusion of the treaty a beef-ox or two to each tribe. If the reason is explained to them, as they will of course know what to expect when the treaty is ratified, they will be perfectly contented. Should the suggestions elsewhere made be adopted, arrangements may be in progress before the first distribution, which will much reduce the cost of delivering the annuities. The estimates in other respects have been made for a small party of officers and their necessary attendants. No troops are required, and every additional person only adds to the expense and prevents celerity of movement.

As nearly two years must elapse after the conclusion of a treaty before a ratification can take place, an appropriation be made, the goods purchased, forwarded, and transported to the place of distribution in the usual course, it is recommended that an appropriation for the first payment be made in advance, that the goods may be on hand as soon as the ratification takes place. Goods for the eastern part of the Territory should be shipped to Portland or Fort Vancouver; those for the western, to Puget sound. But most of the necessary articles can now to better advantage be purchased in San Francisco than imported from the States, and it is recommended that this course be pursued.

In every treaty concluded with these tribes, it should expressly be stipulated that for offences committed against the persons or property of the whites, the chiefs in the first instance shall be held responsible for the delivery of the offender and the restoration of the goods, and that, further, the amount of all damages shall be deducted from the annuity of the tribe. The chief should receive some compensation for his responsibility, and be assured of the support of the government in maintaining his authority.

With proper judgment and care, no difficulty is to be apprehended in managing the relations with any of the tribes east of the Cascade mountains. They are none of them disposed to hostilities against the whites, and the most that is to be feared is an occasional theft. Parties of two or three might traverse the whole country without annoyance. Neither are they at variance with one another, but pass fearlessly from tribe to tribe. Petty jealousies of course exist, as they do between band and band in the same tribe; but there is no serious dissension, calculated to lead to warfare among themselves. Policy requires that some military force should be maintained in the neighborhood of the great emigrant trails, and perhaps hereafter a post may be required on the main Columbia, at or near Fort Colville; but for this there is no present necessity. Whatever force is employed should, however, be cavalry, and during the summer should be kept constantly in motion.

One principle of policy, in particular, should be observed—the union of small bands under a single head. The maxim of divide and conquer does not apply among these people. They are never so disposed to mischief as when scattered and beyond control; whereas it is always in the power of the government to secure the influence of chiefs, and through them to manage their people. Those who at present bear the name have not influence enough, and no proper opportunity should be spared of encouraging and supporting them in its extension. This policy, long pursued by the Hudson's Bay Company, was one secret of their former great influence.

It has been mentioned that a portion of the Wallah-Wallahs, together with the Nez Perces and the Cayuses, live upon the borders of the two Territories, and partly in each.

In relation to this state of things, it will be perceived that some arrangements must be made between the two superintendencies, to prevent clashing in their government. The Wallah-Wallahs proper, and the other bands south of the Columbia and Snake rivers under the Yellow Serpent, may very well be separated from the Yakimas, as they already in fact, and together with the other two tribes, remain under the jurisdiction of Oregon. The three are intimately connected with one another. The Wallah-Wallahs and Nez Perces speak dialects of a common language, and the Cayuses have abandoned their own for that of the latter. They have greatly intermarried, their countries adjoin, and their separation would be almost as impossible as the division of the tribe itself. Their relations with the Oregon agency and people have, moreover, been of long standing, and will remain more intimate than with those of this Territory. Except the Bannaks and the Snakes, they form the only tribes falling within the eastern division of Oregon.

Treaties should nevertheless be concluded with them at once on behalf of the citizens of both Territories, and in the mean time their subsequent jurisdiction be permanently fixed.

The most judicious, and at the same time the most economical, mode of organizing the department, would probably be to divide the Territory into two districts, one on each side of the mountains, in both of which there should be a full agent. It should be his duty to visit in person, at least once in each year, every tribe in his district, pay the annuities, supervise the farmers or laborers employed to assist the Indians, and generally to act as the deputy of the superintendent. The agent should be authorized to employ an assistant or clerk, who should live with him, and during his absence on tours of inspection, manage the business of the office. When it is recollected that the Territory embraces eleven degrees of longitude by six in latitude, it will be obvious that the superintendent, especially when his duties are united with those of the executive, cannot give his personal attention to distant tribes, and that the most responsible duties must necessarily be discharged by subordinates. Their pay and position should be such as to secure men thoroughly qualified, both by character, ability, and familiarity with the Indians. The pay of a sub-agent, barely equal to the lowest wages of common labor, cannot be expected to secure the efficient service of any man in such a situation, much less of a competent one. As the agent himself cannot personally supervise all the different tribes in learning the use of their tools, the proper arrangement of their crops, building fences, &c., it is recommended, further, that the superintendent, under the sanction of the department, be authorized to allow the pay of a sub-agent to not more than one person for each principal tribe of Indians who shall settle among them, and under his direction, or that of the agent, assist in teaching them. Should this, however, not be deemed advisable, the agent should be allowed to hire for at least three months during each of the first two years after the ratification of the treaty, a person suitable for the task.

Their own cattle would, among the eastern tribes, suffice for their wants in breaking up their land, and doing the requisite hauling. In the western agency the work would require to be done chiefly by hand, as the wooded country of the coast does not afford sufficient range, and the Indians have but few horses, and no cattle. Another provision ought to be made for the protection of their fields in that district. Settlers taking up lands adjoining the reserved grounds should be compelled to do half the fencing necessary to exclude their hogs and other stock, the Indians, under the direction of the agent, doing the remainder. As it is, they are exposed to the loss of their little provision, and government will probably be called upon to remunerate them for the damage.

The location recommended for the eastern agency is the neighborhood of the old Chemakaine mission, which affords good land and timber, and is both central to the district and accessible to wagons from Wallah-Wallah or Fort Colville. For the western agency, some point on or near the southern end of Whidby's island would probably be the most convenient.

The Columbia river should be constituted a sub-agency, to have jurisdiction over the scattered bands of the Upper and Lower Chinooks, and those of the Klikatats who reside either in whole or in part among them. The boundaries of this jurisdiction can be settled by the superintendent, as it is advised that the Indians living within it be for the most part left to the operation of civil law; the duties of the sub-agent will not be more onerous than can be performed with the necessary attention to his other occupations, and no particular residence need be furnished or designated.

In the present condition of the Territory there is great confusion as to the applicability of the laws regulating intercourse with the Indian tribes. For certain purposes it is Indian country, while for others it assuredly is not, and in every respect it is desirable that Congress draw the line of distinction.

The difference between the eastern and western sections of the Territory may require some few differences in legislation. The western portion is as yet the only one where settlements have been made; it is there that the bulk of the population will continue to be; but very radical amendments are demanded in the other also. The following have suggested themselves:

Act of June 30, 1834. Section 2, prohibiting trade with the Indians without license, to be repealed, except, of course, in spirituous liquors, the introduction of which into the Territory east of the mountains may continue to be illegal. West of them, however, the law as against importation is nugatory, and should be repealed. The repeal of sections 3, 4, 5, and 6, will necessarily follow. In case of the settlement of the country by the whites, there will of course be merchants and traders, and the Indians should have the right to purchase where they can get the best and cheapest goods. This they will do in any event, and the section will continue to be a dead letter, even if not repealed.

Section 7 to be limited to clothing and goods of American or European manufacture. These Indians have few peltries, and look forward to the sale of stock, horses, and potatoes, as a benefit to be derived from the incoming of settlers.

Section 9 to be repealed, and, as a substitute, the marking of cattle, horses, mules, hogs, and other domestic animals, with conspicuous ear or other marks, to be required, which marks, as in the western States, to be recorded in the office of the clerk of the county; a penalty to be affixed to the effacing of marks, adopting a mark previously recorded, forging a mark, or falsely marking animals.

Section 20. It is proposed that in lieu of the penalty here affixed, the *jury* shall impose the fine—not, however, to be less than say $50 for each offence; and also the term of imprisonment, if that is not repealed. One practical difficulty in the execution of the present law is, that juries are inclined to consider the amount of the penalty as too great to rest upon Indian evidence only; some other changes will follow from the amendment proposed to section 25.

Section 25. For the purpose of better defining the limits of federal and territorial jurisdiction, it is proposed that the power of the former shall extend to all cases of *felony*, and that of the latter to cases of *misdemeanor;* that the federal courts have also power to appoint commissioners in each county, whose duties and powers shall be the same as those of commissioners of the United States courts in other States and Territories, and who shall be entitled to the same fees as justices of the peace in the Territory of Washington.

As an additional section, it is recommended that in all cases where the military forces of the United States shall be employed against Indians, and shall take as prisoners or enforce the delivery of persons accused of any crime, it shall be competent for them to try by court-martial and inflict such punishment as the case may warrant, even to that of death. The object of this provision is, the greater impression upon the tribes produced by a speedy punishment, and the saving of the great expense consequent upon the keeping of prisoners until courts can be convened at distant places. The rules of the common law, moreover, in relation to evidence, are so glaringly inapplicable to cases where Indian testimony is taken, that a conviction would be utterly impossible in most instances, if depending entirely upon it.

There is another measure which, under proper regulations, it is believed would prove of essential benefit to the Indian, and of great convenience to the citizen—a well-considered system of apprenticeship. Neither those of the coast nor those of the interior have any objection to service; on the contrary, they all regard it as an advantage in securing a certainty of food, and the means of purchasing necessaries. Large numbers of Spokanes, Yakimas, &c., come down in the winter to Vancouver, Portland, and the other towns, to seek employment, and their number is yearly increasing. They do small jobs, and work as boatmen, porters, and house-servants, and, besides many presents of clothing, get good wages, averaging thirty dollars a month. They are, however, as might be expected, inconstant, and after a short time return to their homes, or spend their money in gambling before seeking work again. In a country where labor is as much needed as it is here, even this comparatively unprofitable kind is in demand. Were, however, a measure adopted which would give permanency to the relation of master and servant, and at the same time protect the rights of the latter, the value of Indian labor would be greatly raised. As it is, many persons hold slaves, purchased from their Indian masters, who are to a certain extent profitable, though they are generally of the worst class. The Indians show considerable mechanical ingenuity, and would undoubtedly make good blacksmiths, carpenters, and mechanics generally. As household domestics, attendants on the saw-mills, and in many other ways, they can be employed to advantage; but it is especially as farm servants that the proposed measure would be most useful, as, at the expiration of their term of service, they would carry back with them a sufficient knowledge of agriculture to improve their condition at home. I would therefore recommend that the superintendent of Indian affairs, or any full agent, under such general regulations as the superintendent may direct, be authorized, with the consent of the parents or next relations, to bind any Indian child as an apprentice to a citizen of good character and standing, on such terms and for such time as may be agreed upon, not, however, to extend beyond the period when the apprentice shall reach the age of twenty-one years; the contract subject to be terminated by the superintendent or agent, should he be satisfied of personal ill-treatment, immoral use, or an intention to leave the Territory. As the practical details of such a system can hardly be perfected in advance, and as abuses might arise which would require an earlier action than could be procured from Congress, it is suggested that the superintendent be vested with entire powers, subject only to the revision of the department.

These measures, it is believed, are sufficiently comprehensive to cover the whole ground, and at the same time preserve all that is requisite of the system.

The western division of the Territory remains to be considered. On the Columbia river and at Shoalwater bay are a few remnants of the once numerous Chinooks. Of these there were, properly speaking, two nations—the Upper and the Lower Chinooks; the former extending from the Dalles nearly to the Cowlitz river; the latter from thence to the ocean. As these are better known from previous accounts than any others on the Pacific, it is unnecessary to dwell at length upon them. Besides the small party at the Cascades already referred to, there are of the Upper nation but five bands, living at different points on the Washington side of the river, and one at the mouth of Dog river, in Oregon. In whatever arrangement is made, it would be well to include the whole. They number but about 200. Of the Lower Chinooks there are six or seven settlements, most of which consist of single families. The one on Chinook beach is the largest, and amounts to 66. Almost all these are, however, intermingled with the Chihalis. One of their grounds is upon the south side of the Columbia, opposite the mouth of the Cowlitz, and therefore in Oregon. The total number of this tribe is reduced to about 120. There are four persons who claim to be chiefs: Ske-ma-que-up at Wahkiakum, To-tili-cum at Woody Island, E-la-wah at Chinook, and Toke at Shoalwater bay. As this last named locality has only recently been much known, a rather more particular notice of it is not out of place. It was really the principal seat of the Chinooks proper, who resorted to the Columbia mostly for their spring salmon, while they dug their clams and procured their winter supplies on the bay. It formed, in fact, a perfect Indian Paradise in its adaptation to canoe travel and the abundance of scale and shell-fish which it furnished. The southern half of the bay belonged to them; the country on the Willopah river to the tribe of that name, and the upper end to the Chihalis. Trails now partially obliterated and overgrown connect it with the Cowlitz, the Chihalis, and different points on the Columbia, with the people of which the inhabitants kept up a trade in dried fish and clams, purchasing in return kamas, wappatoo, and other foreign commodities. At present but few Indians remain here, the smallpox having nearly finished its work during the past year. In the winter and spring it spread with great virulence along the coast as far north as Cape Flattery. Some lodges upon the southern peninsula of Shoalwater bay were left without a survivor, and the dead were found by the whites lying wrapped in their blankets as if asleep.

Quite extensive cemeteries are scattered along the bay, the canoes in which the bodies of former generations were deposited having out-lasted the race itself.

The Willopahs, or, as called by Capt. Wilkes, Qualioquas, may be considered as extinct, a few women only remaining, and those intermarried with the Chinooks and Chihalis.

Part of the Chihalis Indians still frequent the bay for fish, clams, and oysters, and, with the Chinooks living there, are employed by the whites in taking the latter for market. They bring their canoes along the coast: if the water be smooth, paddling outside the breakers; if rough, trailing them with great dexterity between the surf and the beach. They have some horses, and this beach is a favorite race-ground. The number of the tribe upon Gray's harbor, and that part of the river from the Satsop down, is supposed to be about one hundred and fifty. No settlements have been made on Gray's harbor, and only three claims taken up; but it is impossible to foresee at what moment population may thrust itself into any district, and another season may find this occupied throughout.

There are said to be several other bands inhabiting the northern branches of the Chihalis, the Whishkah, Wynoochee, &c., between whom and the whites there has been no intercourse whatever, and who have never been included in any estimate. For the present purpose they may, with sufficient probability, be reckoned at three hundred. The Indians of the Upper Chihalis will be considered in connexion with the Cowlitz.

Following up the coast, there is another tribe upon the Kwinaitl river, which runs into the Pacific some twenty-five miles above the Chihalis, its headwaters interlocking with the streams running into Hood's canal and the inlets of Puget sound. Little is known of them except that they speak a different language from the last. Still farther north, and between the Kwinaitl and the Makahs, or Cape Flattery Indians, are other tribes whose names are still unknown, but who, by the vague rumors of those on the Sound, are both numerous and warlike. All these have been lately visited by the smallpox, with its customary desolating effects.

The Cowlitz, likewise a once numerous and powerful tribe, are now insignificant and fast disappearing. The few bands remaining are intermingled with those of the Upper Chihalis. According to the best estimates obtained, the two united are not over one hundred and sixty-five in number, and are scattered in seven parties between the mouth of the Cowlitz and the Satsop.

The Taitinapam, a band of Klikatats already mentioned, living near the head of the Cowlitz, are probably about seventy-five in number. They are called by their eastern brethren wild or wood Indians. Until very lately they have not ventured into the settlements, and have even avoided all intercourse with their own race. The river Indians attach to them all kinds of superstitious ideas, including that of stealing and eating children, and of travelling unseen.

Upon the estimates above stated, the whole number of all the Indians south of Puget sound, and between the Cascades and the coast, would amount to about eight hundred and fifty, in place of three thousand, the estimate of Captain Wilkes in 1841—a diminution of — per cent. per annum.

In regard to all these tribes, scattered as most of them are in small bands at considerable distances apart, it seems hardly worth while to make any arrangements looking forward to permanence or involving great expense. The case of the Chinooks and Cowlitz Indians in particular seems desperate. They are all intemperate, and can get liquor whenever they choose. They are, besides, diseased beyond remedy, syphilis being with them hereditary as well as acquired. The speedy extinction of the race seems rather to be hoped for than regretted, and they look forward to it themselves with a sort of indifference. The duty of the government, however, is not affected by their vices, for these they owe, in a great measure, to our own citizens. If it can do nothing else, it can at least aid in supporting them while they survive. They live almost altogether among the whites, or in their immediate neighborhood, taking and selling salmon, or doing occasional work, and for the rest letting out their women as prostitutes. No essential advantage would, it is feared, be obtained by removing them to any one location, for they would not long remain away from their old haunts, and probably the assignment of a few acres of ground for their villages and cemeteries, and the right of fishing at customary points, would effect all that could be done. Still, if they should manifest such a wish, the experiment might be tried of settling each tribe in one village at some place not yet occupied, and constituting it a reserve. This, except during the salmon season, might remove them somewhat farther from temptation.

The tribes that inhabit the region bordering on Puget sound and the Straits of Fuca alone remain; and in speaking of them, it will be most convenient to commence with the Straits, and following up Hood's canal to the inlets at the head of the Sound, thence return northward by the eastern shore and the islands, to the boundary line of the British provinces.

The Makahs, or Classets, inhabit the coast in the neighborhood of Cape Flattery, their country extending but a short distance up the Straits, where it adjoins that of the Clallams. Their language is said to extend down the coast about half way to Gray's harbor. This tribe, which has been the most formidable to navigators of any in the American territories on the Pacific, numbered, it is believed, until very recently, five hundred and fifty.

During the last year the smallpox found its way to their region, and, it is reported, reduced them to one hundred and fifty, their famous chief, Flattery Jack, being among the number who died. The Makahs resemble the northwestern Indians far more than their neighbors. They venture well out to sea in their canoes, and even attack and kill the whale, using for this harpoons pointed with shell, and attached by a sinew line to seal-skin floats. It is said that the year previous to the sickness, they took 30,000 gallons of oil. This was purchased chiefly by vessels. They also take a number of sea otter—the skins of which are sold at Victoria—and raise a good many potatoes.

Among their articles of manufacture are blankets and capes, made of the inner bark of the cedar, and edged with fur. Their houses are of considerable size, often fifty to a hundred feet in length, and strongly built. They sometimes place their dead in trees, at others bury them. Their marriages are said to have some peculiar ceremonies, such as going through the performance of taking the whale, manning a canoe, and throwing the harpoon into the bride's house. The superior courage of the Makahs, as well as their treachery, will make them more difficult of management than most other tribes of this region. No whites are at present settled in their country; but as the occupation of the Territory progresses, some pretty stringent measures will probably be required respecting them.

Next to the Makahs are the Clallams, or, as they call themselves, S'Klallams, the most formidable tribe now remaining. Their country stretches along the whole southern shore of the Straits to between Port Discovery and Port Townsend; besides which, they have occupied the latter place, properly belonging to the Chimakum. They have eight villages, viz: Commencing nearest the Makahs, Okeno, or Ocha, which is a sort of alsatia or neutral ground for the runaways of both tribes; Pishtst, on Clallam bay; Elkwah, at the mouth of the river of that name; Tsewhit-zen, or False Dungeness; Tinnis, or Dungeness; St-queen, Squim bay, or Washington harbor; Squa-que-hl, Port Discovery; and Kahtai, Port Townsend. Their numbers have been variously estimated, and, as usual, exaggerated; some persons rating them as high as 1,500 fighting men. An actual count of the last three, which were supposed to contain half the population, was made by their chiefs in January, and, comprehending all who belonged to them, whether present or not, gave a population of only 375 all told. The total number will not probably exceed 800. That they have been more numerous is unquestionable, and one of the chiefs informed me that they once had one hundred and forty canoes, of eighteen to the larger and fourteen to the smaller size; which, supposing the number of each kind to be equal, gives a total of 2,240 men.

One cause of the over-estimate so frequently made of Indians, is their habit of moving about, gathering in bodies—one day at one place, and at another the next; thus leaving the impression of great numbers in each. Many of the Clallams of Vancouver's island, too, visit the American side of the Straits, and swell the apparent population. The total of all the tribes in this part of the Territory has, however, been placed rather under than over the mark, for many of them live altogether off the Sound, and have not come in contact with the whites.

The head chief of all the Clallams was Lach-ka-nam, or Lord Nelson, who is still living, but has abdicated in favor of his son, S'Hai-ak, or King George—a very different personage, by the way, from the chief of the same name east of the mountains. Most of the principal men of the tribe have received names either from the English or the "Bostons;" and the genealogical tree of the royal family presents as miscellaneous an assemblage of characters as a masked ball in carnival. Thus, two of King George's brothers are the Duke of York and General Gaines. His cousin is Tom. Benton; and his sons, by Queen Victoria, are General Jackson and Thomas Jefferson. The queen is daughter to the Duke of Clarence, and sister to Generals Scott and Taylor; as also to Mary Ella Coffin, the wife of John C. Calhoun. The Duke of York's wife is Jenny Lind; a brother of the Duke of Clarence is John Adams; and Calhoun's sons are James K. Polk, General Lane, and Patrick Henry. King George's sister is the daughter of the late Flattery Jack. All of them have papers certifying to these and various other items of information, which they exhibit with great satisfaction. They make shocking work, however, in the pronunciation of their names; the *rs* and *fs* being shibboleths which they cannot utter.

It is a melancholy fact that the Clallam representatives of these distinguished personages are generally as drunken and worthless a set of rascals as could be collected. The Clallam tribe has always had a bad character, which their intercourse with shipping, and the introduction of whiskey, have by no means improved.

The houses of the chiefs at Port Townsend, where they frequently gather, are of the better class—quite spacious and tolerably clean. Two or three are not less than thirty feet long by sixteen or eighteen wide, built of heavy planks, supported on large posts and cross-beams, and lined with mats. The planks forming the roof run the whole length of the building, being guttered to carry off the water, and sloping slightly to one end. Low platforms are carried round the interior, on which are laid mats, serving for beds and seats. Piles of very neatly-made baskets are stored away in corners, containing their provisions. There are from two to four fires in each house belonging to the head of the family, and such of his sons as live with him. They have an abundance of salmon, shell-fish, and potatoes, and seem to be very well off. In fact, any of the tribes living upon the Sound must be worthless indeed not to find food in the inexhaustible supplies of fish, clams, and water-fowl, of which they have one or the other at all times. They have a good deal of money among them, arising from the sale of potatoes and fish, letting out their women, and jobbing for the whites.

The Clallams, and in fact all the other Sound Indians, flatten their heads. Their canoes are of different models; the common one being that known as the Chinook canoe, the most graceful of all; some of which are of large size and great beauty. They have, besides, one called the Queen Charlotte's Island canoe, which, in a heavy sea, is preferable to the first as less liable to be boarded astern. The canoe used for duck-shooting is very pretty, and exceedingly well adapted for the purpose. It sits low on the water, and an Indian seated in it, and gliding noiselessly along beneath the shadows of the trees, or lying beside some projecting log, would need sharp eyes to detect him. Another and very large canoe, of ruder shape and workmanship, being wide and shovel-nosed, is in use among all these tribes for the transportation of their property and baggage. Among their characteristic manufactures are blankets or robes made of dogs' hair. They have a kind of cur with soft and long white hair, which they shear and mix with a little wool or the ravellings of old blankets. This is twisted by rolling on the knees into a cord or coarse yarn, and is then woven on a frame. They use the down of water-fowl in the same way, mixing it with hair, and forming a very thick and warm fabric.

The Clallams, as well as the Makahs and some other tribes, carry on a considerable trade with Vancouver's island, selling their skins, oil, &c., and bringing blankets in return. At present it is hardly worth while to check this traffic, even if it were possible; but when the white population increases, it may become necessary as a revenue measure. In any treaties made with them, it should enter as a stipulation that they should confine their trade to the American side. Apart of the Clallams are permanently located on that island, and it is believed that their language is an extensive one. The Lummi, on the northern shore of Bellingham bay, are a branch of the same nation.

This tribe have, within the last year, been guilty of the murder of three Americans, as well as of several robberies. For the first, that of a man named Pettingill, one of the two perpetrators was secured by arresting the chief, and has been in custody at Steilacoom some months waiting his trial. The other case was the murder of Captain Jewell, master of the barque John Adams, and of his cook, and was unknown till recently, as it was supposed that Jewell had absconded. In both cases the parties had considerable sums in their possession, which fell into the hands of the Indians. On learning of the last affair, a requisition was made by Governor Stevens upon the officer commanding the military post at Steilacoom, and a party promptly despatched there to support the special agent in securing the criminals.

Some severe lesson is required to reduce them to order, as their natural insolence has been increased by the weakness of the settlements near them, and by the facility with which they can procure liquor. The establishment of a military post at some point on the Straits would be very desirable for the purpose of overawing them and their neighbors.

Above the Clallams are the Chimakum, formerly one of the most powerful tribes of the Sound, but which, a few years since, is said to have been nearly destroyed at a blow by an attack of the Snoqualmoos. Their numbers have been probably much diminished by the wars in which they were constantly engaged. They now occupy some fifteen small lodges on Port Townsend bay, and number perhaps seventy in all. Lately, the Clallams have taken possession of their country, and they are, in a measure, subject to them. Their language differs materially from either that of the Clallams or the Nisqually, and is not understood by any of their neighbors. In fact, they seem to have maintained it a State secret. To what family it will ultimately be referred, cannot now be decided. Their territory seems to have embraced the shore from Port Townsend to Port Ludlow. Still above the Chimakum are the Toanhoock, occupying the western shore of Hood's canal. They are a branch of the Nisqually nation; but their dialect differs greatly from those on the eastern side of the Sound. They amount to about 265. With them may be classed the Skokamish, upon the head of the canal, who probably number 200. Neither of them have had as much intercourse with the whites as most of the Sound tribes.

Upon Puget sound, and the inlets communicating with it, are several small bands, the remnants of once larger tribes, formerly all, it is believed, under one head chief. Of these the Squalli-ah-mish or Nis-qually is the most numerous, and deserves particular mention as having given its name to the general language. Their respective numbers will be given in the general statement.

To the north of this group, another may be formed of those inhabiting the shores of Admiralty inlet from Puyallup river to Suquamish head, including Vashore's and Bainbridge's islands, Port Orchard, Elliott bay and the D'Wamish river, and Port Madison. Most of them are nominally under a chief named Se-at-tle, belonging to the Suquamish tribe, but residing principally with another, the D'Wamish. This last is the one called, on the charts of Puget sound, the Nowamish; and it should be mentioned that a very considerable difference in the spelling of almost all these names exists, arising from the fact that several letters of their alphabet are convertible; as D and N, B and M, Q and G. For instance, the band in question are indifferently termed N'Wamish and D'Wamish; another clan of the same trio, the Samamish, are also called Sababish; and the name Suquamish is frequently changed into ———. The D'Wamish are the best known of this connexion, from their neighborhood to the rising town, named after their chief Se-at-tle, and the whole generally bear their name, though they are by no means the most numerous. Their proper seat is the outlet of a large lake emptying into the D'Wamish river, and not on the main branch. At that place, they, and some others, have small patches of potato ground, amounting altogether to perhaps thirty acres; where, it is stated, they raised during the last year about 3,000 bushels, or an average of one hundred bushels to the acre. Of these they sold a part, reserving the rest for their own consumption. Each head of a family plants his own, the quantity being regulated by the number of his women. Their potatoes are very fine, though they have used the same seed on the same ground for a succession of years.

The jealousies existing among all thesepetty bands, and their fear of one another, is everywhere noticeable in their establishing themselves near the whites. Whenever a settler's house is erected, a nest of Indian rookeries is pretty sure to follow if permitted; and in case of temporary absence, they always beg storage for their valuables. The compliment is seldom returned, though it is often considered advantageous to have them in the neighborhood as spies upon others. Some amusing traits of character occasionally develop themselves among Indians, of which an instance happened with these. A saw-mill was erected during the last autumn, upon the outlet of the lake, at a place where they are in the habit of taking salmon. The fishery was much improved by the dam, but what afforded the greatest satisfaction to them was its situation upon their property, and the superior importance thereby derived to themselves. They soon began to understand the machinery, and took every visitor through the building to explain its working, and boast of it, as if it had been of their own construction.

The southern end of Whidby's island, and the country on and near the mouth of the Sinahomish river, belong to the Sinahomish tribe. These number, including the bands connected with them, a little over 300. Their chief is S'Hoot-soot, an old man who resides chiefly at Skagit head. Above them, and upon the main branch of the river, is another band, not under the same rule, the Snoqualmoos, amounting to about 200 souls. Their chief, Pat-ka-nam, has rather an evil celebrity among the whites, and two of his brothers have been hung for their misdeeds. This band are especially connected with the Yakimas, or, as they are called on the Sound, Klikatats.

It requires notice in this place, that besides the tribes, or bands, inhabiting the shores and the lower part of the rivers, there are on the headwaters of the latter, along the whole course of the Cascade mountains, another range of tribes, generally independent of the former, who rarely descend from their recesses, but are intermediate in their habits between the coast and mountain tribes; except the Taitinapam, however, they all belong to the general family upon whose borders they live. Those in the neighborhood of the passes own a few horses, which subsist in the small prairies skirting the base of the mountains.

The tribes living upon the eastern shore possess also territory upon the islands, and their usual custom is to resort to them at the end of the salmon season—that is, about the middle of November. It is there that they find the greatest supply of shell-fish, which form a large part of their winter stock, and which they dry both for their own use and for sale to those of the interior. The summer and fall they spend on the main, where they get fish and put in their potatoes.

Below the Sinahomish come the Stoluchquamish, (river people) or, as their name is usually corrupted, Steilaquamish, whose country is on a stream bearing their name; and still north of them the Kikialtis. No opportunity has afforded itself for accurate inquiry into the numbers of either. The first are said by some to amount to two hundred, while the latter may perhaps be set down at seventy-five. The next tribe proceeding northward are the Skagits, who live on the main around the mouth of the Skagit river, and own the central parts of Whidby's island, their principal ground being the neighborhood of Penn's cove. They have lately diminished in numbers and lost much of their influence since the death, a year or two since, of their chief, S'neetlum, or, as he was commonly called, Snakelum. The tribe has been long at enmity with the Clallams, who have attempted to encroach upon their lands. The Skagits raise a considerable quantity of potatoes, and have, besides, a natural resource in their kamas, which grows abundantly on the prairies of Whidby's island. Both of these are now being greatly injured by the cattle and hogs of the settlers. The kamas, it is worth mentioning, improves very much by cultivation, and it is said to attain the size of a hen's egg in land that has been ploughed. Swine are exceedingly fond of it. The Skagits are about three hundred all told; and there are other bands upon the headwaters of their river, amounting probably to as many more.

Below the Skagits again, occupying land on the main upon the northern end of Whidby's island, Perry's island, and the Canoe passage, are three more tribes, the Squinamish, Swodamish, and Sinaahmish, probably two hundred and fifty or three hundred altogether; and lastly the Samish, on the small river of that name and the southern part of Bellingham bay, estimated at one hundred and fifty. With these, according to the best information procurable during a rapid journey of inspection, the Nisqually nation terminates, the next tribe to the north speaking a dialect of the Clallams.

It is probable that that of the Samish is a by-word between the two.

The Lummi, living on a river emptying into the northern part of Bellingham bay and on the peninsula, are variously estimated at from four to five hundred. Their chief is Sáhhopkan; in general habits they resemble the Clallams.

Above the Lummi, on the main fork of the river which is said to rise in and carry off the water from Mount Baker, is still another considerable tribe called the Nooksáhk. They seem to be allied with the Lummi and the Skagit, and, according to Indian account, they speak a mixed language. They are supposed to be about equal in numbers to the Lummi.

The Shimiahmoo inhabit the coast towards Frazier's river; nothing seems to be known of them whatever. They are probably the most northern tribe on the American side of the line, the Kowailchew lying principally, if not altogether, in British territory.

Concerning the tribes north of the Sinahomish, nothing but estimates founded on the opinions of the few settlers in that district could be gathered, the opportunity afforded by a hasty voyage through the Sound being, of course, very limited. Steps have been taken to correct them. The general result, it is believed, will warrant the estimates furnished.

Accompanying the recapitulation of the tribes in the western district will be found the estimate of Captain Wilkes in 1841, and one calculated by the Hudson's Bay Company in 1844, which was politely furnished by Dr. Wm. F. Tolmie, at Fort Nisqually. The latter exhibits what, according to the best information, is the decrease since that period in the tribes then known, but no adequate data then existed on which to base a reliable comparison. For the purpose of procuring certain returns hereafter, a form is herewith enclosed, and it is recommended that the agents be obliged annually to make out as fully as practicable.

Some variations from the plan suggested for the management of the eastern district will necessarily suggest themselves in respect to the western, though it is believed they are not material; but owing to the great number of small bands into which most of the Indian population is broken up, the labor of treating with and disposing of the latter will be much the greatest. It is therefore recommended that a separate commission be appointed for that district.

In order to bring the whole subject fully before the government, estimates have been prepared, based upon the best opinions and information attainable, of the expenses of negotiating treaties with the tribes of each district; of the annual payments they may be expected to involve; of the cost of establishing agencies, and finally of the yearly expense of maintaining them. It is believed that the plan suggested will prove efficient, and that the expense is but trifling, compared with the extent of the country to be purchased; the number and situation of the tribes occupying it, and, above all, of the advantage to be secured to the Territory in the quiet and effectual settlement of perspective difficulties. No plan, however well devised, can be successful without the concurrence of the citizens; and in making these suggestions, the advice of men possessed of experience in Indian relations has been obtained.

GEORGE GIBBS.

Capt. George B. McClellan,
Commanding Western Division N. P. Railroad Exploration.

I have examined the foregoing report, and fully approve of Mr. Gibbs's views as therein expressed, and would respectfully recommend that they be adopted.

GEORGE B. McCLELLAN,
Lieutenant Engineers and Brevet Captain Commanding, &c., &c.

The estimates, as they relate to the Indian service solely, and as they are not approved by me, are not submitted. The Nez Perces are almost exclusively in Washington Territory; and being closely affiliated with the other tribes of the Territory, accompanying them always in their annual hunt, they should be attached to the Washington superintendency. There should be three agencies in the Territory—the eastern, central, and western agencies—for reasons set forth in my reports to the Indian bureau, and which have been approved both by the department and by Congress. By a law of Congress it is made the duty of the officers of the Indian department to make all treaties with Indians. Hence, the proper commissioners will be the Indian superintendent and his agents. There are minor points which are not approved; but the report, generally, is submitted as one of ability, and as exceedingly creditable to its author.

ISAAC I. STEVENS,
Governor of Washington Territory.

Census of various Indian tribes living on or near Puget Sound, N. W. America, taken by W. F. Tolmie in the autumn of 1844.

Names of tribes.	Men.	Women.	Boys.	Girls.	Slaves.	Total population.	Horses.	Canoes.	Guns.	Remarks.
Stak-ta-mish	62	62	39	21	23	207	89	27	13	Between Olympia and Nawau-kum river.
Squaks'na-mish	33	44	28	25	4	135	5	17	7	
Se-hêhwa-mish	29	23	7	30	3	92	......	14	7	
Squalli-a-mish	138	162	75	66	30	471	190	92	48	
Pu-yal-lup-a-mish	69	81	37	33	7	207				
S'Ko-ma-mish	34	22	34	28	7	118	......	34	14	
Su-qua-mish	158	102	113	97	64	525	5	160	93	
Sin-a-ho-mish	102	100	61	59	......	322	......	61	28	
Sno-qual-mook	122	153	65	25	8	373	......	36	27	
Sin-a-ah-mish	78	37	47	22	11	195	......	36	8	
Nooh-lum-mi	65	57	52	47	23	244	......	60	15	
						2,6[illegible]9				

Captain Wilkes's Estimate—1841.

Tribes and localities.	Population.
Chinooks	209
Pillar Rock, Oak Point, and Columbia river	300
Cowlitz	350
Chihalis and Puget Sound	700
Nisqually	200
Port Orchard	150
Penn's Cove, Whidby's island, including the main land, (Scatchae tribe)	650
Birch Bay	300
Clallams at Port Discovery, New Dungeness, &c.	350
Port Townsend	70
Hood's canal, (Suquamish and Toando tribe)	500
Total	3,779

Estimate of Indian tribes in the Western district of Washington Territory—January, 1854.

Names of tribes and bands.	Where located.	Men.	Women.	Total bands.	Total tribes.	Remarks.
Upper Chinooks—5 bands, not including Cascade band.	Columbia river, above the Cowlitz				200	Estimate.—The upper of these bands are mixed with the Kli-katats; the lower with the Cowlitz.
Lower Chinooks—						
Chinook band	Columbia river, below the Cowlitz, and Shoalwater bay.	32	34	66		One of these is intermixed with the Cowlitz—the rest with Chihalis.
Four others, (estimate.)				50	116	
Chihalis	Gray's harbor and Lower Chihalis river.			100		Estimate.
Do	Northern forks Chihalis river			200		Estimate.
					300	
Cowlitz and Upper Chihalis.	On Cowlitz river and the Chihalis, above the Satsop.				165	The two have become altogether intermixed.
Tai-tin-a-pam	Base of mountains on Cowlitz, &c.				75	Estimate.
Quin-aik, &c.	Coast from Gray's harbor northward.				500	Estimate.
Makahs	Cape Flattery and vicinity				150	Estimate.
S'Klallams	Straits of Fuca					
Kahtai	Port Townsend	67	88	155		
Ka-quaitl	Port Discovery	24	26	50		
Stent-lum	New Dungeness	79	91	170		
All others	False Dungeness, &c., westward			475		The last estimated.
					850	
Chima-kum	Port Townsend				70	
To-an hooch	Hood's canal	123	109	265		Some of the women omitted in the count, but estimated.
Sko-ko-mish	Hood's canal—upper end			200		Sko-ko-mish estimated.
					465	
Guak-s'n-a-mish	Case's inlet, &c	19	21	40		
S'Kosle-ma-mish	Case's inlet, &c	14	13	27		
Sa-heh-wa-mish	Hammersly's inlet, &c	11	12	23		
Sa-wa-mish	Totten's inlet, &c	2	1	3		
Squa-aitl	Eld's inlet, &c	22	23	45		
Stell-cha-sa-mish.	Budd's inlet, &c			20		Estimate.
Nov-seh-chatl	South bay			12		Estimate.
					170	
Squalli-ah-mish—six bands.	Nisqually river and vicinity	84	100	184		
Steila-coom-a-mish	Steilacoom creek and vicinity			25		
					209	
Pu-yallup-a-mish.	Mouth of Puyallup river, &c			50		Estimate.
T'Qua-qua-mish	Heads of....do......do			50		Estimate.
					100	
Su-qua-mish	Peninsula between Hood's canal and Admiralty inlet.	215	270	48		
S'alo-ma-mish	Vaston's island	18	15	33		
					518	

ESTIMATE—Continued.

Names of tribes and bands.	Where located.	Men.	Women.	Total bands.	Total tribes.	Remarks.
D'Wamish	Lake Fork, D'Wamish river	89	73	162		
Sa-ma-mish S'ke-tehl-mish	D'Wamish lake, &c	71	30	101		
Smul-ka-mish	Head of White river			8		
Skope-ah-mish	Head of Green river			50		
Se-ka-mish	Main White river			30		
					351	
Sin-a-ho-mish	South end Whidby's I. L., Sinahomish river.	161	138	350		Part of the women omitted, but included in the total.
Quuk-ma-mish Sky-wa-mish	Upper branches, north side Sinahomish river.					
Sky-wa-mish Sh-tah-le gum	Upper branches, N. side Sinahomish river.			300		Estimate.
Sno-qual-mook	South fork, north side Sinahomish river.			195		
					845	
Sto-luch-wa-mish	Sto-luch-wa-mish river, &c			200		
Kikiallis	Kik-i-allis river, L. Whidby's island.			75		
					275	
Skagit	Skagit river and Penn's Cove			300		Estimate.
N'qua-cha-mish Sma-lih-hu Mis-kai-whu Sa-ku-me-hu	Branches of Skagit river			300		Estimate.
					600	
Squi-na-mish Swo-da-mish Sin-a-ah-mish	North end Whidby's island				300	Estimate.
Samish	Samish river and Bellingham bay				150	
Nook-sank	South fork Lummi river				450	
Lum-mi	Lummi river and peninsula				450	
Skim-i-ah-moo	Between Lummi Point and Fraser's river.				250	
					7,559	

FORM OF CENSUS RETURN.—GENERAL INSTRUCTIONS.

The census should be taken every year at the time when the Indians are most collected together. The easiest method of obtaining it, and liable to least chance of confounding different tribes, is to employ the chief or head man to count by tallies of sticks. Special pains should be taken to ascertain correctly the number of bands into which each tribe is divided, and the names of the petty as well as the principal chief. Any other statistical details may be stated under the head of general remarks.

The report must be forwarded to the superintendent, with the estimates of the agency for the service of the ensuing year.

Census of ——— band belonging to the ——— tribe of Indians, living at ———, in Washington Territory, taken ——— 185 , by ———, agent.

Names of bands and tribes.	Names of chiefs and sub-chiefs.	Principal residence.	Men.	Women.	Boys.	Girls.	Slaves.	Total.	Canoes.	Horses.	Cattle.	Bushels of potatoes.	Remarks.

40. REPORT OF LIEUT. JOHN MULLAN, U. S. A., ON THE INDIAN TRIBES IN THE EASTERN PORTION OF WASHINGTON TERRITORY.

CAMP STEVENS, BITTER ROOT VALLEY,
Washington Territory, November 18, 1853.

SIR: I have the honor to state that your instructions with reference to the council of Indians to be held at Fort Benton during the coming season have been duly carried out, and information has been given to all Indians visiting this place concerning the same. The objects and results to be obtained have been fully set before them and explained in detail, and now especially do the Flatheads await particularly for the expected change that will be wrought, through the agency of the government, in their relations with the Blackfeet Indians.

The Flatheads, as a nation, have more reason to complain of a want of attention and care, on the part of the government, than any other tribe of Indians, probably, in North America.

Their numbers have been so greatly diminished during the last few years, by being murdered by the Blackfeet, that at present there remains but a handful of the noblest of the Indian tribes of North America to tell the tale of woe, misery, and misfortune, that they have suffered at the hands of the Blackfeet, these hell-hounds of the mountains.

For years now has their country been the theatre where have been committed murders the most brutal, and robberies the most bold and daring, until there is not left a spot but that is pointed out to the traveller where some innocent and unsuspecting Flathead was put to the knife in cold blood, or where were shot down scores of friendly Indians, by these devils of the mountains. So long has this state of things existed, the word "Blackfoot" has become the by-word of terror and fear among all the tribes of Indians west of the Rocky mountains; and now it is that the young Flathead child is taught, as soon as it can comprehend the words of its father, to watch and guard his nation against the inroads of these devilish fiends.

Thus are the seeds of enmity and hate thus early sown; and when the child becomes the full-grown man, he deems it his duty, a duty he owes not only to his family but to his tribe, to ward off the encroachments of these their enemies. Thus it is that deadly feuds have ever existed among these Indians, and so will they ever exist until our government shall take such measures as shall put an end to the same.

When you passed through the country of the Blackfoot nation, they promised to live on terms of friendship with their neighbors the Flatheads, and now I have to communicate that since that time they have kept their promise most faithlessly. News has just reached me, by the Pend d'Oreille Indians, that while the chief, Victor, was on his way to the buffalo hunt, east of the Missouri, he encamped on a prairie after having crossed the dividing ridge, and while there a part of his horses were stolen by a war party of Blackfeet. There were Pend d'Oreilles with him also at the time. The Flatheads started in pursuit of the Blackfeet, and succeeded in killing one and wounding a second. The dead body of the Blackfoot was seen by Mr. Tinkham's party on their route from Fort Benton to this place. The Pend d'Oreilles being highly incensed at this want of faith on the part of the Blackfeet, they having been told by Victor that they had promised you most faithfully to abstain from all further depredations, followed the Blackfeet into Fort Benton, and there seeing a band of horses and mules, they chose from this band a number of Indian horses. These they thought belonged to the American Fur Company. They reason thus: "Here are these whites, the employés of the American Fur Company, who have bought, and who do still buy, from the Blackfeet the horses that they steal from us, thus giving encouragement to their thieving propensities; and here are some of our horses; we will take them off;" and so they did. On arriving at the camp of Victor they narrated what had taken place, when the chief Victor told the Pend d'Oreille chief to take the horses back to Fort Benton, and turn them over to the chief at the fort; and this they did. The horses were turned over to Mr. Clark at Fort Benton. These same Pend d'Oreilles joined Mr. Tinkham on their return, on his fifth day out from Fort Benton, and accompanied him to the village of St. Mary's.

The chief Victor said that the Flatheads had promised to live in peace with the Blackfeet, and only to war when their lives were threatened, and that none of his men should steal horses from either the whites or Indians; that, since you had promised to protect them, the matter should be referred to you. Here, then, is an act of bravery, nobleness, and honesty, on the part of these Indians, that is but seldom, if ever, met with among any other tribe of Indians, either east or west of the Rocky mountains; and here, too, is a strong and evident example of the reputed faithlessness of the Blackfoot nation.

This last act of bad faith on the part of the Blackfeet has occurred at a most unpropitious period. Since here I have told the Pend d'Oreilles and Flatheads of the council to be held at Fort Benton, and the promises of the Blackfeet; but here the Blackfeet, by their acts, have given the lie to everything that I have told the Flatheads; and now I fear that the Flatheads will place all the promises made you by the Blackfeet in the same category that they have placed those made to them and others for the last half century. They have told me that the Blackfeet have made the same promises time and again, and as often have they been violated. And now I would most urgently recommend to you that the absolute and great necessity of the establishment of a military post, at or near Fort Benton, be set forth before the proper department, and that immediate action be taken on it. The necessity for this is becoming more and more apparent, and is being more and more felt every day. The presence of a military force only will restrain the Blackfeet from their incursions and depredations on their neighbors. The council, should it be held next summer, will probably do a great deal towards the settling of the feuds that exist among these northern tribes; but I fear that it alone will prove ineffectual. It, however, with the presence of a military force, will, I think, succeed in putting an end to the enmity that has existed among these tribes for centuries back.

They have never been made aware of the power and influence of the government, save in your council with them at Fort Benton; and what they now need is to have the fear of the government held over them. And a policy I should recommend would be, should they continue to keep their pledges as faithlessly as they have before, that our military force should be sent among them, put every man, woman and child to the knife, burn down their villages, and thus teach the nation that since persuasion will not, force must and shall effect the ends that we have in view. This will be a forcible, and, I think, salutary example to them, and will, I think, be the only means of accomplishing the purposes of the government. They had better by far be totally exterminated than left to prowl the mountains, murdering, plundering, and carrying everything before them.

I have also found, myself, in this valley, a Nez Perces scalp taken by the Blackfeet quite recently, and but a few days have elapsed since twenty-five of them were taken at Hell Gate; and thus, I think, they will ever be through the land of the Flatheads, until they receive a prompt, thorough, and severe chastisement at the hands of the government.

Truly, your obedient servant,

J. MULLAN,
Lieutenant United States Army.

Governor I. I. Stevens,
In Command of N. P. Railroad Survey, &c.

Fort Hall, Oregon Territory,
December 14, 1853.

Sir: I have the honor to report, that previous to leaving the country of the Flathead Indians, on the 28th of November last, I had assembled the chiefs and principal men of the tribe together, when I distributed among them such presents as you left with me, and at the same time communicated to them what you had done, and what you had intended and promised to do for them; and particularly setting before them the objects of the council to be held at Fort Benton during the next summer. They received the intelligence of the council with much joy and exultation, and they now look forward to the coming summer as a time from which they are to date a new and happy period in their nation's history. In reply to the many things told them, they said they were deeply and fully aware that they were a helpless and miserable race of beings; but now their hearts were glad to hear that the government had not neglected them, but that it intended to send an agent among them, who would superintend their interest and welfare; they said what they wanted the government to do for them now was, to send a man among them who would teach them how to till the soil, and to send them agricultural implements and seeds; and that they neither desired nor demanded more than this.

And now what I would recommend is the appointment of an intelligent, reliable man; one who, with a good moral character, combines a degree of firmness and resoluteness, and at the same time is an excellent practical farmer, and who is also a member of the Catholic church. This last I mention and recommend from the fact that the Jesuit priests have been among the Flatheads for ten or twelve years, and have laid among them a foundation upon a better and firmer basis than has ever been laid among any Indian tribe either east or west of the mountains, upon which a superstructure can now be built which will be an ornament not only to the district where it will be erected, but to our whole nation. This man, so appointed, could perform the duties of Indian sub-agent; could enclose a farm, and have the necessary buildings, in the Bitter Root valley, to whom the Indians could apply in need for information and help; who, by his high moral stand, could and would exert a powerful and salutary influence over the Indians; and who could, in case the mission is re-established at the St. Mary's village, fully co-operate with the priests there stationed, and cause the Bitter Root valley, at no distant day, to teem with life, business, and happiness. Such a man, no doubt, can be found in Oregon who would willingly accept of such a post; if not in Oregon, at least in the States. And another thing I would recommend would be, that the man should be a married man, with a family. He would thus have every inducement to comfortably settle himself for life, and be less disposed to become dissatisfied, and thus destroy the good intentions of those who have the supervision of our Indian affairs. While at this place, application has been made to me, by a man living at Fort Hall, for the post for his father, who at present is a farmer at Manayunk, Philadelphia county, Pennsylvania, and also a Catholic, with a family. His name is Hugh Damsy. I told him I would mention his case to you. As to who he is, his capacity, &c., I know nothing; only his son seems to be an upright, sober man, and who, from year to year, trades on the emigrant road.

I think myself some man should be appointed whom you well know, or who comes to you recommended by those who have had an opportunity of judging of him. That there is a necessity, and that a great one, that some one should be among the Flatheads to teach them to till the soil, there can be no manner of doubt; and as it has been partially promised them, and as they fully expect it, I recommend to you that it be urgently set forth before the proper department, and that action should be had upon it during the session of the coming Congress. I shall be able to send you, by Lieutenant Grover, the present number of the Flatheads, their relations, power, intercourse with other tribes, &c. The report of the council at Fort Benton has spread throughout the whole Indian country as on the wings of lightning, and has been received as the harbinger of glad tidings to all. It is a matter that *must not* be let fall to the ground. but the sparks that have been struck by our expedition must be fanned into a flame until it shall envelope all the Indian tribes both east and west of the Rocky mountains. For myself, I feel a deep interest in it, and, for one, should regret to hear that our government had overlooked, either partially or completely, the interests of so many thousands of souls that it is in duty bound to protect. One great result obtained from this council, and of course the treaty, will be the settling of the whole of the eastern portions of Washington and Oregon Territories, and thus blot out forever from the map of our country what is now looked upon as the great desert, as it were, extending from the Missouri to a hundred miles west of the Rocky mountains, thus occupying a central position in the heart of our country, and replace it by one continued belt of thriving settlements and villages, where the stir and bustle of business shall resound, without cessation, as along our civilized and settled borders. Should the matter be let passed during the coming season, I doubt whether it can ever be undertaken again under as favorable auspices. Should you have received any intelligence from Washington in regard to the subject, you will oblige me by referring to it in your communication to me in the Bitter Root valley.

Truly, your obedient servant,

J. MULLAN,
Lieutenant United States Army.

Governor I. I. STEVENS,
In Command of N. P. Railroad Survey, &c.

CANTONMENT STEVENS, BITTER ROOT VALLEY,
Washington Territory, January 25, 1854.

SIR: I have the honor to report that, in conformity to your letter of instructions, dated at the Flathead village of St. Mary's, October 3, 1853, "to report on the probable cost of erecting agency buildings, &c., in the Bitter Root valley, and the cost necessary for keeping up the same," upon examination I find there will be needed a building for an agent, for the Indian farmer, a council-room, a store-room, a blacksmith's shop, a building for the blacksmith, and two employés for the Indian farmer, and a room for the interpreter. I deem it necessary that a full agent should be sent to this section, and that the tribes included in this agency should be the Flatheads, the Pend d'Oreilles, and the Kootenaies; for these but one interpreter will be needed, since the man Gabriel, whom I have employed as interpreter, speaks each of the languages, and who could be appointed the interpreter for the agency. I think the agency should be established at or somewhere near the "Hell Gate," which is the great thoroughfare for all the Indians in going and returning from the buffalo hunt east of the mountains. Should any sub-agents be appointed, one is needed, beyond a doubt, among the Flathead Indians; and I therefore recommend to you that an appropriation of five thousand dollars be made to defray the expenses of erecting the buildings, furnishing five yoke of oxen, supplying blacksmith's tools, &c., furnishing ten ploughs, seed for farming, one wagon, such carpenter's tools as would be needed, and, in a word, for supplying the agency with everything needed. I am confident that the Indians will do a great deal towards the erection of the buildings, &c.

There will be needed, then, one agent—pay	$1,500 00
One interpreter	500 00
[The pay should be $500 for an interpreter, since he can speak three languages.]	
Pay of Indian farmer	500 00
Pay of two men associated with the farmer, at $300	600 00
Presents to Indians visiting agency, &c., in goods, &c	500 00
Provisions to be given to Indians visiting the agency on business, &c., to consist of sugar, coffee, beans, rice, and hard bread	500 00
Meat provision to be obtained in the country	500 00
	4,600 00
For travelling and contingent expenses	1,000 00
	5,600 00

making a total of five thousand six hundred dollars for the annual expense for keeping up the agency, &c., which, in my judgment, is the smallest possible amount with which the agency can be carried on. I have made the estimates the smallest possible, judging from what experience I have had among the Indians in this valley. With regard to the remaining items referred to in your letter, I will report in my next communication, as there are points which need more consideration than I have as yet had time to devote to them.

Truly, your obedient servant,

J. MULLAN,
Lieutenant U. S. Army.

Governor I. I. STEVENS,
In Command of N. P. Railroad Survey, &c.

It seems to me that the supply for the agency in this valley might be supplied by steamboat navigation up the Missouri to Fort Benton, thence across the mountains to this point. I will be able, however, to report more in detail on this point on my return from Fort Benton.

J. MULLAN.

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41. REPORTS OF MR. JAMES DOTY ON THE INDIAN TRIBES OF THE BLACKFOOT NATION.

FORT BENTON, *December* 28, 1853.

DEAR SIR: Enclosed you have additional receipts, omitted to be sent by Mr. Tinkham, for quartermaster's property in my hands.

As requested in your letter of October 3, 1853, I send herewith a report upon those particulars concerning the Blackfoot nation which you directed me to examine. It includes the plan of a farm and list of agricultural instruments, and is accompanied by a rough draught of the agency buildings deemed necessary.

By the enclosed thermometrical register, since October 1st, you will perceive that we have had no cold weather, no snow, and indeed no winter. Can the same be said of the entrance to the South Pass?

We are passing the winter comfortably if not pleasantly. The men have conducted themselves in all respects in a praiseworthy manner.

Rations will hold out tolerably well, with the exception of flour and coffee. In case an express is sent to this point, I would suggest that a pack-horse or two be also sent, loaded with flour, coffee, and beans.

Early in this month I procured, without cost, about 1,000 pounds of fresh meat by sending out pack-horses with the Indian hunters, so there is no danger of starvation. The oxen, horses, and mules are in first-rate condition; many of them are fat.

I am happy to inform you that the three horses reported to you as stolen have been returned; so that up to date not an animal in my charge has been lost.

The recovery of these horses is worthy of notice, as indicating, in the Indians who returned them, an honesty, and moral as well as physical courage, seldom seen among white men, and never expected of Indians.

On the 1st of November, six Pend d'Oreille Indians came to this post and delivered up all the horses that were stolen. It appears that they were taken by two young Pend d'Oreilles, and run to the Pend d'Oreille camp, then hunting beyond the Muscle Shell, under the command of the chief of that nation, "Alexander." The horses were recognised by the stamps as belonging to the whites, and the young men confessed having stolen them at this post. A council was held, and it was determined that it was a great sin to steal horses from white men who were friendly to them; that the wishes of the "Great Soldier Chief," who had been at the St. Mary's, were known to them, and they had promised compliance with them; that stealing these horses would give the Pend d'Oreilles the name of liars and triflers; that they had always borne a good name, and were ashamed to have mean things said of them now: therefore, the horses must be taken back by their great chief and five principal men of the tribe; accordingly, they came boldly to the fort and delivered up the horses without asking any reward, but, on the contrary, expressing much sorrow and shame that they had been taken.

Thus these six Indians proved themselves not only honest, but brave in the highest degree, coming, as they did, five days' and nights' march into an enemy's country simply to do an act of justice to strangers. They remained here two days, and on departing were accompanied by Mr. Clarke and myself fifteen or twenty miles on their journey. During their stay here a number of Piegan warriors about the fort became very troublesome to the strangers; so much so, that we were compelled to detail a strong guard for their protection.

Suitable presents were given them from the Indian goods left with me. No event of great importance has occurred among the Indians since your departure.

The "Little Dog's" camp was attacked not long since by a party of Crees and Assiniboins, and himself and another were wounded. He has, however, determined not to revenge it, but to wait until the council is held.

I am sorry to inform you that many of the Indians do not abide by their promises to remain at peace this winter. About five hundred, principally Piegans, have passed this post, on their way to war, since October 1st; about one hundred were induced to turn back. In the same time eight hundred or a thousand warriors must have passed above and below the fort, on their way to the Flatheads, Snakes, and Crows, as I have, from time to time, heard of large parties of Bloods, Blackfeet, and Gros Ventres, on the march; and parties are constantly going from the different bands.

Several of the chiefs have taken a very decided stand for peace, and keep the warriors of their own bands at home. Others say, "this is the last winter we can go to war; next summer the white soldiers will stop us; therefore, let us steal this winter all the horses we can."

It is becoming a serious question in my mind whether these Indians will desist from their predatory incursions until a sufficient military force is stationed in the country to check every attempt at sending out war parties. No military force, however, is needed to protect white men in this country.

Good interpreters for the government are very difficult to procure, because such can get higher wages from the traders than the government pays. The only man I can at present recommend is a Mr. Bird. He is a half-breed, English and Blackfoot; is an elderly man, respectable and intelligent, and the best interpreter in the country. He may not wish the situation of interpreter at the agency, but can no doubt be engaged for a council.

In my intercourse with these Indians I have been especially careful to have them understand that I made them no promises.

Trusting that we may see you at an early day in spring, I am, very respectfully and truly, yours,

JAMES DOTY.

Governor I. I. STEVENS,
Washington Territory.

FORT BENTON, *December* 29, 1853.

SIR: In compliance with the request contained in your letter of October 3, 1853, I have the honor to submit the following report, which is necessarily incomplete and brief, owing to the limited time for acquiring extended and accurate information upon the points treated of.

The numbers 1st, 2d, 3d, &c., refer to the like numbered inquiries in your instructions from the Commissioner of Indian Affairs, under date of May 9, 1853, and to which you directed my attention.

1st. The number of tribes to be included within this agency is one, known generally as the Blackfoot nation. Their general locality, which is understood to mean the country in which they reside or hunt, is bounded as follows: By a line beginning on the north, where the 50th parallel crosses the Rocky mountains; thence east on said parallel to the 106th meridian; thence south to the headwaters of the Milk river, down said river to the Missouri, up the Missouri to the mouth of the Judith; thence up the Judith to its source to the Rocky mountains, and north along their base to place of beginning.

The country between the Missouri and the headwaters of the Yellowstone is unoccupied. It is the great road of the Blackfoot war parties to and from the Crows, Flatheads, and Snakes. It may also be considered as a transient hunting ground of the Flatheads, as they hunt buffalo there for a short time in the fall.

2d. The Blackfoot nation is divided into four distinct tribes or bands, whose names, numbers, and localities are as follows:

The Bloods....	350 lodges;	2,450 population;	875 warriors.
The Blackfeet................	250	1,750	625
The Piegans.................	350	2,450	875
The Gros Ventres...........	360	2,520	900
Total	1,310	9,170	3,275

The Bloods and Blackfeet occupy the country upon the source of the Marias and Milk rivers to the 50th parallel of latitude.

The Piegans occupy the country between Milk and Marias rivers, upon Marias river and the Teton, and between the Teton and the Missouri.

The Gros Ventres occupy the country bordering upon Milk river from its mouth to the territory of the Piegans. These Gros Ventres, although incorporated with and now considered a part of the Blackfoot nation, are clearly a band of Arrapahoes who seceded from their nation some forty years since, passed over to the Crow Indians, were plundered and killed by that nation, losing many of their women and nearly all their horses and guns. They wandered over this country several years, plundered two forts at the north, were driven away by the Kootenaies; and finally, in a destitute and miserable condition, settled some thirty years since in the country they now occupy. The Blackfoot nation in a manner adopted them, *i. e.*, made a lasting peace, and gave them many horses. The traders supplied them with guns and ammunition; their horses increased; they made many robes and soon became wealthy, and are now more independent, saucy, and unfriendly to the whites than any other band of the Blackfeet.

The Bloods, Piegans, and Blackfeet speak the same language peculiar to the Blackfoot nation.

The Gros Ventres speak the Arrapahoe language, which is not understood by any white man or Indian, not of their tribe, in this country. Most of the Gros Ventres, however, speak the Blackfoot sufficiently for purposes of trade.

3d. Their character is warlike. They are warriors and horse-thieves by profession and practice, and are always at war with some or all of the neighboring nations.

Their present disposition towards the whites is unquestionably friendly. Undoubtedly, a party of white men may travel through this country in perfect safety. The only danger would be, that the Indians might take them for Indian enemies and rush upon them in the night. Their horses might be stolen, unless under the protection of a chief or an influential white man, one who is friendly and well known to them.

4th. The only white inhabitants of this country are the traders and their employés at the American Fur Company's post, Fort Benton, and at Mr. Harvey's, or the opposition fort. These are on friendly terms with the Indians, as is evidenced by the fact that they are constantly sending traders with large quantities of goods to remote points in the Blackfoot country, who are not only permitted to go and come without molestation, but are treated with much kindness and hospitality at the camps. The horses at this post are always turned out to pasture without a guard, and are seldom or never stolen.

So far as has been ascertained, their present relations with the Hudson's Bay Company are simply those of a limited trade, which is entirely confined to a portion of the Blackfeet and Blood bands. These Indians procure in the northern part of their territory a considerable number of small peltries, and in the summer—at which season they go farthest north—trade them at one of the Hudson's Bay Company's posts on the Saskatchawan river; "Chesterfield House," I think. This trade is carried on for two reasons: first, because the Indians are paid there a higher price for their small peltries than is given by American traders; secondly, they procure at that post an abundance of whiskey; and it is undoubtedly this latter consideration that induces them to go. In the winter they generally come upon the Marias river and trade their robes at the American traders' winter posts on that river, because they obtain more for robes here than at the north. But I have lately understood that a new proprietor at Chesterfield House has offered for robes the same price that is paid here; in consequence of which, a large number of Bloods and Blackfeet have started for the north. Deeming it my duty so to do, I sent them tobacco and a message to induce them to return; warning them that in case they did not return, they need not expect to participate in the benefits of a treaty that might be concluded with the remainder of their nation.

5th. No conventional arrangements exist between the Indians and white inhabitants of this country to be respected in the event of a treaty.

6th, 7th, and 8th. At present but one agent will be required. The agency should be located near this point, and embrace the four above-named tribes or bands of the Blackfeet nation.

9th. The employés required at present for the contemplated establishment of an agency and farm will be one interpreter, one farmer, one blacksmith, and three laborers.

10th. The amount required for the erection of the agency buildings and fixtures will be $12,000. A rough draught of the buildings contemplated is herewith submitted, and an offer has been made to construct them upon this plan for the price above mentioned at any point in this vicinity. It is proposed to use adobes in the construction of all buildings. I consider them the cheapest, warmest, driest, and most enduring building material to be obtained in this vicinity. Barns, small outbuildings, fences, pickets, &c., if necessary, will be constructed by agency laborers, and without much cost to the department. The offer to erect the agency buildings is by Mr. Clarke, at $10,000, if on the Highwood, or $12,000 at Sun river or other points. Being in the country, and situated as they are, either Mr. Clarke or Mr. Harvey can underbid any one out of the country; and I consider the enclosed plan, at the price mentioned, the cheapest and most practicable method of building the establishment.

11th. The contingent expenses, $1,000.

12th. The amount of presents to be distributed annually will probably be determined when a treaty is held and confirmed; I estimate $4,000.

13th. For provisions, $1,000.

I regard the project of establishing a farm for these Indians as entirely practicable: first, because farms have succeeded among all our Indian tribes where the experiment has been thoroughly tested; second, because in my recent journey through the Piegan, Blackfeet, and Blood Indian camps, the establishment of an agency and farm was fully explained to all the principal chiefs, and not only were they unanimously in favor of the project, but promised that, in case a farm should be started, they and their people would work upon it and give it a fair trial. I have not yet visited the Gros Ventres, but understand that for several years they have been very anxious to be taught how to cultivate the soil.

I propose to locate the agency at the point most favorable for farming, regard of course being had to facilities for communication with the head of navigation on the Missouri. The spring and fall are the most favorable periods to judge of the general nature of the soil, in the absence of chemical tests; but from such information as I have been able to acquire during the winter, and consulting the wishes of the Indians, I should consider a point on the Highwood near its mouth, or on the Sun river at its junction with the Missouri, favorable locations for an agency and farm. There are two other localities that may be mentioned: the valley of Marias river, and the southern slope of the Bear's Paw mountain. The former I have already examined, but of the latter I cannot speak with certainty until an examination is made in the spring; but I think they are neither of them equal to the localities first mentioned.

It is of course necessary to have a supply of the best simple agricultural implements, and some person who thoroughly understands their use to instruct the Indians how to use them. As precept is of little value without example, it is proposed to employ a good practical farmer and laborers to assist him, who can the first year start a small farm and cultivate it well. This may be styled a seed farm, as *all* the cereals and roots adapted to a northern climate should be cultivated. The cereals that succeed, if any, will furnish the seed, and the vegetables will clearly indicate which of them can succeed in this soil and climate. If the experiment is successful, then the second year a large farm can be started, seeded with those grains and vegetables that have been proved, upon which all the Indians who choose can work under the direction of the farmer, with the preceding year's example before them, and encouraged by a fair certainty that their labor will not be in vain. With all the Indians I am acquainted with, a failure in a first attempt is losing the whole battle; they can rarely be brought to the charge again. But, by adopting the above plan of farming, such a failure could not occur. The agricultural implements, means of transportation, &c., deemed necessary to carry on the business of the farm and agency the first year, are given below:

3 yoke of oxen, with yokes; 2 heavy wagons; 6 log chains; 2 whip saws; 2 cross-cut saws; 1 chest of carpenter's tools; 2 dozen Collins's axes and handles; ½ dozen shovels; ½ dozen spades; 2 steel breaking ploughs, fourteen-inch cut; 6 cast cross ploughs; 1 double harrow frame; 4 grain cradles and scythes; 1 dozen scythes and snaths; 1 dozen steel hoes; 1 dozen pitchforks; 1 grindstone; 1 dozen scythe-stones.

The second year would require an increase proportionate to the number of Indians disposed to work.

In conclusion, I think, from the observations I have been able to make, that a treaty with these Indians and the establishment of an agency and farm in their country will do much towards changing them from a warlike and nomadic to a peaceable and agricultural nation. I trust that you may accomplish those objects at an early day. My desires as well as my duty prompt me to aid in their accomplishment to the extent of my ability.

Hoping that the information contained in this somewhat hurried report may meet your wishes, I am, very respectfully, your obedient servant,

JAMES DOTY.

Governor I. I. STEVENS,
Washington Territory.

FORT BENTON, *December* 29, 1853.

DEAR SIR: In accordance with instructions, I have performed one of the contemplated trips to the winter trading-posts. Starting from here on the 14th instant, I struck Marias river at the point where the road to the Three Buttes crossed it. A large number of the Piegans were encamped at this point. Remaining here two days, I held a council with the chiefs and principal men, repeating to them, in substance, your speech at the council at the fort the day before your departure, and explaining the project of an agency and farm; with which they seemed much pleased, and expressed their willingness to work on a farm when the opportunity should be afforded them.

Travelled up the river fifty miles, running a compass line and noting the topography. Saw several encampments, and met many Indians on their march down; and on the 18th reached "Ammell's Houses." Here were encamped nearly the whole of the Blood, Blackfeet, and Northern Piegan bands.

A council was held, at which thirteen of the great chiefs and many of the principal men were present. I spoke to them much the same as I had spoken to the Piegans, but at greater length. Several of the chiefs replied, and all expressed much friendship to the whites; promised to attend the council, and to give the farm—with the idea of which they were much pleased—a fair trial.

The great Piegan chief, the "Little Gray Head," who has taken a very decided stand for peace with neighboring tribes, was present, and I gave him a present out of the Indian goods left with me. Tobacco purchased of Mr. C. was given to the principal men.

Learning that a portion of the Blood Indians were in camp five days' march to the north, and intending to go to the British posts to trade, I sent them tobacco and a message to induce them to turn back.

I passed two days here, and had an excellent opportunity to acquire much interesting information concerning the manners, customs, habits, &c., of these Indians, which is fully recorded in my official journal, and would be out of place in this letter or a brief report. Returned to Fort Benton on the 23d.

You will learn by Messrs. Tinkham and Grover somewhat concerning my intended operations in the field the coming spring; but it may not be amiss to express my idea of the direction in which the survey is to be conducted, and the objects to be accomplished thereby.

Having, before the season for active operations arrived, made a thorough examination of the country in this vicinity, I propose to commence with the survey of Sun river from its mouth to its source; thence to the head of Dearborn river, and down that river to its mouth; thence to the junction of Madison and Wisdom rivers; thence to the sources of the Muscle Shell, and down that river to a point near its mouth; thence parallel with the Missouri, crossing and examining Judith, Big Horn, and other rivers, to Fort Benton.

Particular regard will be had to the character of the streams; general nature of the soil; tracts adapted to cultivation; the timber and stone, and facilities for obtaining them; the collection of mineralogical and geological specimens, and making an extensive botanical and natural history collection.

Lieutenant Grover leaves me a Schmalcalder compass, so that an accurate survey will be insured. A sextant will be used to determine the latitude.

It is expected that this survey will occupy at least forty days, and, undoubtedly, much valuable and interesting information will be acquired.

As I shall have to procure another man, in order to leave two of my present command at the post—one to take the observations, and one in charge of the government property—I think that man should be a good interpreter. Arrangements for his pay must be made. Then my absence from my post will be a long one; and, in view of these things, it would afford me much satisfaction to see you in person, or receive by an express your instructions in the premises, previous to my setting out, which I have fixed for the 1st of May at the latest.

In case an express is sent, I will thank you to forward my letters and a few newspapers.

I am, very respectfully and truly, yours,

JAMES DOTY.

Governor I. I. Stevens,
Washington Territory.

42. REPORT OF MR. J. M. STANLEY'S VISIT TO THE PIEGAN CAMP, AT THE CYPRESS MOUNTAIN.

WASHINGTON CITY, *January* 19, 1854.

SIR: In accordance with your verbal instructions to proceed to the Cypress mountain in search of the Piegan band of Blackfeet and bring them into council at Fort Benton, I have the honor respectfully to submit the following report:

From the point of your return near the Marias river to Fort Benton, September 11, 1853, I proceeded with three voyageurs and an interpreter of the American Fur Company, under the guidance of "Little Dog," one of the chiefs of the Piegan band. Our course was north 20° west over an elevated plain, gradually ascending to the base of the "Three Buttes"—a distance of thirty-five miles from our encampment on the Marias river.

The "Three Buttes" are of conical shape, rising about 3,000 feet above the Coteau, covering an area of fifteen miles square, serving as a prominent landmark to the prairie voyageur.

They are pretty well covered with pine timber, and from their base spring several small streams, flowing west into the Marias and east into Milk river. We found the grass luxuriant, and, in many places, in all the freshness of spring. It is the favorite fall pasture of the buffalo, elk, and other game, which we saw in numerous herds.

Continuing our course, September 12th, we cross the base of the Three Buttes on to Milk river—a distance of thirty miles. The country, gradually ascending to the north, was much broken with deep coulées running to the eastward into Milk river. On the heads of these coulées we found clear running water; but as we advanced, crossing them at a greater distance from the Buttes, found only occasional pools. In one of these ravines, twelve miles from the Buttes, I saw a stratum of coal, three feet thick, running one-fourth of a mile, with a slight dip to the east.

Buffalo, elk, deer, and antelope are abundant. Arrive at Milk river early in the afternoon. Nature is here exhibited in a wonderful manner, and I paused to take a glance at the magnificent scene from the top of a castelated butte running two hundred feet above the river. A succession of conical and table-hills, composed of different-colored clays in horizontal strata jutting into the valley, presented the appearance of an irregular street in a quaint old city.

At this point the valley is one mile in breadth, studded with cotton-wood groves and undergrowth. Here we found three lodges of Piegans belonging to "Lame Bull's" band, and from whom I learned the Piegans had divided their camp. Lame Bull, with one hundred lodges, had, seven days before my arrival, descended the river, with the expectation of meeting you at the crossing to Fort Benton; and that "Low Horn," with his band, had gone north to the Cypress mountain.

After explaining the object of my visit to their country, I made them presents of ammunition and tobacco, for which they were very grateful, giving me fresh and dried meat in return. Believing Lame Bull would fall upon your trail and proceed to Fort Benton, I determined to follow Low Horn to the Cypress mountain, and thus secure a council with the two principal bands of Piegans.

September 13.—I was detained until 9 o'clock, in consequence of the straying of some of my mules. They were found and brought into my camp by the Indians. Ascending a deep coulée to the north, we find a gradual ascent to the Coteau; cross a high divide, covered with hillocks, a distance of twelve miles, to a dry river bed; valley two miles wide, covered with a thick growth of wild sage. This valley, during the spring, evidently drains a large tract of country, and is also the outlet of a lake, eighteen miles long by five broad, called Pakokee, or Bad Water. Heading northwest of trail, saw several gangs of buffalo, one of which was killed by "Little Dog." Crossing a broken rocky ridge, nine miles, we fell upon another dry bed of river, which we ascended five miles, it terminating in a deep ravine, with scattering cotton-wood, elm, wild cherry, and thorn-apple. We halted near an old Indian fort, made of logs and sticks. The water found in pools was strongly impregnated with saltpetre, and unfit for use. After spending some time in digging for fresh water for our famishing mules, we discovered a good spring on the east side of the ravine, near the fort. During our halt the voyageurs killed several wild pigeons. Continue our march twelve miles, and encamp on a small tributary of Milk river. The soil gravelly and sterile, affording scanty pasturage for our animals.

September 14.—The first rays of the sun found us in the saddle, prepared for a long march. But one day more remained for me to find the Piegan camp. The night had been clear and cold, silvering the scanty herbage with a light frost; and while packing up, the men would stop to warm their fingers over a feeble fire of buffalo-chips and skulls. After a short march of twelve miles, we reached the divide between Milk and Bow rivers.

From this divide I had a view of the Bull's Head, forming the base of Cypress mountain, bearing north 65° west, around the southeastern base of which I could trace a large valley, making a bend to the northeast, carrying its water into Bow river.

From this point I discovered, with my glass, a band of horses, five miles to the westward, which directed me to the Indians I was in pursuit of.

At 1 o'clock I descended to a deep valley, in which flows an affluent of Beaver river. Here was the Piegan camp, of ninety lodges, under their chief Low Horn, one hundred and sixty-three miles north, 20° west, of Fort Benton.

Little Dog conducted me, with my party, to his lodge, and immediately the chiefs and braves collected in the "Council Lodge," to receive my message. The arrival of a "pale face" was an unlooked for event, and hundreds followed me to the council, consisting of sixty of their principal men.

The usual ceremony of smoking being concluded, I delivered my "talk," which was responded to by their chief saying, "the whole camp would move at an early hour the following morning to council with the chief sent by their Great Father."

The day was spent in feasting with the several chiefs, all seeming anxious to extend their hospitality; and while feasting with one chief, another had his messenger at the door of the lodge to conduct me to another. They live chiefly upon the buffalo-meat, preferring it to smaller game. Subsequently, while riding with an old man, he pointed to the numerous herds of buffalo feeding in the distance, and said, "I am an old man, and there you see what I have been living upon all my life; I have never enjoyed the good things of the whites." One of their favorite dishes is composed of boiled buffalo-blood and dried berries, and is served as a dessert after the more solid food. I being a guest whom they wished to honor, had this Indian delicacy served in profuse quantities.

September 15.—At an early hour a town crier announced the intention of the chief to move camp. The horses were immediately brought in and secured around their respective lodges, and in less than one hour the whole encampment was drawn out in two parallel lines on the plains, forming one of the most picturesque scenes I have ever witnessed.

Preparation for their transportation is made in the following manner:

The poles of the lodges, which are from twenty to thirty-five feet in length, are divided, the small ends being lashed together and secured to the shoulders of the horse, allowing the butt-ends to drag upon the ground on either side; just behind the horse are secured two cross-pieces, to keep the poles in their respective places, and upon which are placed the lodge and domestic furniture. This also serves for the safe transportation of the children and infirm unable to ride on horseback—the lodge being folded so as to allow two or more to ride securely. The horses dragging this burden—often of three hundred pounds—are also ridden by the squaws, with a child astride behind, and one in her arms, embracing a favorite young pup.

Their dogs (of which they have a large number) are also used in transporting their effects in the same manner as the horses, making, with ease, twenty miles a day, dragging forty pounds.

In this way this heterogeneous caravan, comprised of a thousand souls, with twice that number of horses and at least three hundred dogs, fell into line and trotted quietly until night, while the chiefs and braves rode in front, flank, or rear, ever ready for the chase or defence against a foe.

The Blackfeet proper are divided into three distinct bands, as follows: The Blood band, 400 lodges; the Piegan band, 430 lodges; and the Blackfeet band, 500 lodges—averaging ten to a lodge—amounting to 13,300 souls.

The Piegan band are subdivided and governed by a head chief, as follows: Lame Bull's band, 100 lodges; Low Horn's band, 100; Little Rogue's, 30; North Wind's, 100; and Big Snake's band, 100.

The Piegan and Blood bands hunt, trade, and winter on American soil, while the Blackfeet extend their hunts as far north as the Saskatchawan river, and trade as frequently with the British as with the American posts.

Like other tribes in this region, the Piegans retain all their primitive customs, adhering with faithful pertinacity to the ceremonies of their forefathers. They are well clad in dressed skins, decorated with the scalps of their enemies. They are well-formed, little above the medium stature, brave, intelligent, and adventurous, roaming vast distances over mountains and plains, carrying war into their enemy's country. During my sojourn among them I was treated with the greatest kindness and hospitality, my property guarded with vigilance, so that I did not lose the most trifling article.

Retracing my trail, I reached Milk river the second day from their encampment on Bow river. Our mules and horses being much jaded, and having had but little grass for five days, the chief recommended we should halt for a day to recruit them. Here the main encampment remained to hunt; thirty of the chiefs with their families accompanying me to Fort Benton, where I arrived on the 20th of September, having been absent eleven days, during which time I made a number of sketches illustrative of their habits; also a partial vocabulary, which is herewith submitted.

I have the honor to be, respectfully, your obedient servant,

J. M. STANLEY,
Artist of the Exploration.

I. I. STEVENS,
Governor of Washington Territory,
in Charge of Northern Pacific Railroad Survey.

The following papers, not enumerated in Chapter XVIII, have been received since the date of Governor Stevens's report.

LETTER OF THE SECRETARY OF WAR TO GOVERNOR I. I. STEVENS.

WAR DEPARTMENT,
Washington, July 25, 1854.

SIR: You will, with as little delay as possible, furnish this department with a report of your operations, embracing—

1st. A map exhibiting the actual line or lines surveyed by yourself, and your assistants, in your late exploration to ascertain the most practicable route for a railway to the Pacific; and also a table, showing the astronomical points determined for checking the lineal surveys, and the data upon which these determinations are founded.

2d. A profile of the route traversed, making each station where a height was ascertained, and a table of the results of the observations made, with the barometer or other instrument, by which the relative heights of different points were determined.

3d. A condensed statement of the character of the soil, the timber, the supply of water, and, as far as ascertained, the depth of snow in winter for every section of the line traversed.

For the immediate use of the government, the relative longitude and the relative height of points along any given line is required. A discussion of the absolute longitudes and heights, also the preparation of the natural history, geology, &c., may be deferred without injury to the object now in view.

The map and profile should indicate new routes or lines to be surveyed, and those heretofore surveyed, by which obstacles on the line followed may be avoided.

Very respectfully, your obedient servant,

JEFF. DAVIS, *Secretary of War.*

Governor I. I. STEVENS.

LETTER OF GOVERNOR STEVENS TO THE SECRETARY OF WAR.

WASHINGTON, *August* 4, 1854.

SIR: In answer to your letter of July 25, I beg leave to report as follows:

1. My general map, forwarded to the department shortly after rendering in my report, exhibits the several lines that come into competition for railroad routes, and the detailed map, scale $\frac{1}{250,000}$, gives the several lines surveyed by myself and my assistants in the recent exploration made by me. I herewith enclose a table of latitudes, which can be relied on as furnishing good results. The observations on north and south stars give results closely approximating.

Our longitude observations are not good. Very many were made, but we failed in the use of the transit, which was relied on to check the work, and to rate the chronometers. Up to a late period I was sanguine that we should master all the difficulties, and get good observations. I have been disappointed. In the journey from Washington city, where the chronometers were rated, to St. Paul, they got out of order, and the rates were not afterwards ascertained with precision. I am of opinion that, with the re-occupation of a few fixed points, as Wallah-Wallah, Fort Owen, Fort Benton, and Fort Union, all the observations will be made available.

I am of opinion, however, that with the latitude observations, and the admirable odometer survey, and the use of Nicollet's longitudes, and those of Captain Wilkes, and those (3) ascertained by Captain McClellan, the map can be relied on, and all inaccuracies in longitude will scarcely be appreciable.

It is due to the exploration and myself to state, that I relied upon Captain Joseph Roberts, who, on his application, was, at my request, detailed for duty with the survey, to take charge of the observations for latitude and longitude. He had a large practical experience in observations, and it was designed to place him in special charge of the transits, with which he was perfectly familiar. At the last moment he got orders relieving him from the exploration, and I was then obliged to depend upon one of the assistants, Mr. George A. Stevens, who, though a good observer and computer, had not the requisite experience in observations on the march for the purpose. It was impossible for me personally to make observations, in consequence of my wretched health the greater portion of the trip. For six hundred miles, in consequence of an old disability, the result of my service in Mexico, I was obliged to ride in an ambulance; and though I took my horse two hundred and fifty miles before I reached the mountains, I suffered severely from debility and fatigue the whole route through.

At Fort Union the observations were placed in charge of Lieutenant Donelson, with instructions, if practicable, to get longitudes by lunar distances; but Lieutenant Donelson was not able to report any results except for latitude.

Lieutenant Saxton was also provided with instruments for observations for latitude and longitude, but furnished no results except for latitude.

I will remark that Mr. Stevens, who is now in the Territory in the capacity of my private secretary, has been industriously engaged since April in making observations, and in familiarizing himself in the use of instruments, and I now consider him well qualified to make observations in the field. All the observations for latitude and longitude are in Olympia.

2. I herewith send the profile of the railroad route via the Bitter Root river and the pass of the lower Columbia. The other profiles are nearly ready to be transmitted. I also transmit the barometrical heights on the trail of the main train. The barometrical observations have been all lost on the isthmus by Lieutenant Donelson.

3. The soil is excellent from the Mississippi river to the Bois de Sioux, in the Mouse River valley, and in the valleys of the several streams flowing into the Missouri. Much of the land is good on Milk river, and on the banks of the Missouri itself. It is excellent in the valleys of the Marias, Teton, Medicine, Dearborn, and the several tributaries at the forks of the Missouri. It is also excellent on the Missouri in the vicinity of Fort Benton, on the Highwood creek, on the Judith river, on the Muscle Shell, and on Smith's river. The valleys of the Hell Gate, Blackfoot, St. Mary's, Jocko, and the several tributaries flowing into the Flathead lake, furnish excellent soil. The soil is good on the several prairies on Clark's fork, in the vicinity of the Cœur d'Alene lake, the several tributaries flowing into that lake, and good for the most part on the banks of the Spokane, and on the western slope of the Cœur d'Alene mountains; and it is good also much of the distance on the railroad route over the Great Plain of the Columbia, and on the Wallah-Wallah river and its tributaries. In the immediate vicinity of Fort Wallah-Wallah the soil is poor. Below Fort Wallah-Wallah, on both banks of the Columbia, the soil for the most part is good, and the grazing excellent. Below the Cascades the soil is rich, and is so for the most part to the mouth of the Cowlitz, and thence to Puget sound. On the southern shore of Puget sound a portion of the prairies is gravelly, although the great portion furnishes fair arable land.

In the Yakima valley there is some good land, and by irrigation a considerable quantity of land could be made available for crops. Crossing the mountains by the Snoqualme Pass, the soil improves, and for some forty miles before reaching the Sound the quality is excellent. This is especially the case back of Seattle.

The grazing is good on the whole route, and between the Bois de Sioux and the Mouse River valley, and between this valley and the Big Muddy river. Between the several river valleys from the Big Muddy to the Medicine river there are many small streams, and valleys furnishing excellent farming locations.

The timber is abundant as far as the Bois de Sioux, and on the route thence to the Grand Couteau heading the Mouse River valley the road can be supplied from the Shayenne, the Miniwakan lake, the coulées and main valley of Mouse river, and various lakes not far from the line of the route. From the Grand Couteau to the Big Muddy river there is little or no timber, and the supply must be furnished from the Missouri and Yellowstone. The same from the Big Muddy to Milk river. From the mouth of Milk river to the mountains temporary arrangements can be made with the cotton-wood, to be replaced, on a through communication being established, by the excellent pines of the Bear's Paw, the Three Buttes, and the Rocky mountains, though it will be practicable, from the Missouri, to extend the track along Milk river by the red cedar and the pines of the Missouri and Yellowstone, and by the use of a branch road to open a new section where the route passes between the Bear's Paw and the Three Buttes. The supply from the mountains to beyond the crossing of the Spokane is inexhaustible; thence for some one hundred miles, to the crossing of the Columbia, there is a scarcity of timber; but inexhaustible supplies can be floated down the Columbia. From the crossing of the Columbia, down its valley to the Cowlitz, and thence to the Sound, the supply is inexhaustible, though from the crossing to the Dalles the reliance must be on the woods of the Columbia, above the mouth of the Wenatshapam. By the route of the Yakima and the Snoqualme Pass there will be ample supplies of timber. Not much is found the first ninety-four miles; but the route being in the valley of the Yakima, there will be no difficulty in rafting down to points where timber is wanted, from its headwaters.

In the timbered region are found pine, larch, spruce, cedar, and fir. East of the Bois de Sioux the growth is principally oak, elm, ash, &c.

There will be no difficulty as to water. It will be deficient at points on the broad plateau between the Milk and Missouri rivers, but by aqueducts it can easily be supplied. The lakes on the Grand Couteau will also furnish the means of supplying any deficiency from the Grand Couteau to a point south of the Miniwakan lake. But our observations go to show that there need be little apprehension of a deficiency here. On the Great Plain of the Columbia, I apprehend no deficiency in the supply of water; the whole country abounds in lakes and small streams.

Our observations and inquiries go to show that the average depth of snow east of the mountains to the Missouri does not exceed one foot. Two feet is an extraordinary depth, and the most experienced voyageurs in that country have never been detained a single day in travelling by snow. The most they have been compelled to do was to lie by till the storm was over.

In the Rocky mountains, and on the line of Clark's fork, the snow is hardly ever deep enough to prevent the Indians travelling with their families on horseback all through the winter: one foot is a common depth, and three feet is a very extraordinary depth, in the Rocky mountains. Last winter the average on the several passes was less than one foot. The winter before—the winter of greatest snow for many years, as shown by the unprecedented rise of the rivers in the following spring—the depth was three feet.

On the Plain of the Columbia, in the lower Columbia valley, and on the route thence to the Sound, the snow is inconsiderable.

On the route of the Yakima and the Snoqualme Pass, there is but little snow for some forty miles eastward from the Sound, and for more than a hundred miles up the Yakima valley. On the pass itself, there was, the last winter, on the 20th January, six feet of light snow for some six miles. The depth, I am of opinion, did not much increase subsequently; but to test the question fully, further observations ought to be made.

For more full information in reference to the forest growths, supply of sleepers, and building-materials for the road, and for the supply of water, I will respectfully refer you to Chapters V and XII of my report. Chapter V treats of the section east of the Rocky mountains, and Chapter XII of the section west. For the depth of snow, I will refer you to Chapter XIV, and to sub-reports I 35, I 36, I 37, and I 38.

The observations for heights having been lost, the discussion of the several altitudes cannot be made till they are recovered; and for longitudes, the only dependence at this time, and before further observations are made, will be to adjust the odometer line in connexion with the latitudes between Nicollet's Lake Jessie and Wilkes's Wallah-Wallah on a projection, and ascertain a particular longitude by protraction; I am confident the result will be good.

The general map indicates lines to be examined, and for full information I will respectfully refer you to Chapter XVIII of my report. I will, however, give the following condensed statement of examinations which I will recommend to be made:

1. More detailed examinations of the line of the lower Columbia and of the line of the Snoqualme Pass, to determine which is most practicable.

2. Careful examinations of Lewis and Clark's, Cadotte's, and the Northern Little Blackfoot Passes, and their several approaches, to determine as to which is most practicable. If Lewis and Clark's or Cadotte's Pass be preferred to the Northern Little Blackfoot, examinations to be made to determine the practicability of passing directly from the Blackfoot trail to Clark's fork. This proving impracticable, or the Northern Little Blackfoot Pass proving preferable, then a careful comparative survey to be made of the line of the Bitter Root and the line of the Jocko.

More careful observations of the southern portion of Clark's fork to be made, to determine whether the road shall pass to the Spokane from the western or the eastern side of the Pend d'Oreille lake.

Examinations to be made to determine the practicability of connecting the Rocky mountain passes with Council Bluffs through the Black Hills, and also to determine whether these passes can be reached from the Bois de Sioux by crossing the Missouri and Yellowstone, and thus abridging distance.

Winter examinations to be continued.

I will here observe that, through the Indian agents and sub-agents, I shall be able to get a large body of meteorological observations with but little additional expense, except the cost of instruments. I will recommend that, whatever operations the department may think advisable to be carried on, on this route, the operations of the fall and winter be restricted to the examination of the lower Columbia and the line of the Snoqualme Pass, and that next spring and summer the operations eastward be vigorously pushed.

I will state that, in connexion with the Blackfoot council, I shall make my arrangements to leave the Sound in April, to reach Fort Benton late in June, and, remaining there six weeks, to return and reach the Sound again in October. I refer to this to show with what ease I shall be able to direct the operations in the field.

My feeble health, the last seventeen days, will explain the delay which has occurred in transmitting this report. It has only been within a day or two that I have been able to do much work.

I am, sir, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

N. B.—Besides the railroad profile referred to in this report, I send the profiles of the route of the main train. The railroad line was got in through the labors of the civil engineers, Messrs. Lander and Tinkham, who were constantly occupied in side reconnaissances, and is the result of the observations on the main trail; of careful observations, by the barometer, of prominent landmarks off the main trail; and of careful observations of the course of streams, and the general trend of the country.

I send also the two sheets giving the work in detail. But I am now engaged in a careful re-adjustment of the latitudes and odometer survey to the longitudes determined by Wilkes and Nicollet, which will occupy me some two or three days, and which will be made the basis of a special report.

LIST OF LATITUDES.

Date.	Place.	Star observed.	Deduced latitude.	Mean.
			° ′ ″	° ′ ″
	Camp Davis	Theta	45 35 12	
		Polaris	17	45 35 14.5
June 16 and 17	Ford of Sauk river	Altair	45 27 00	
		Polaris	27 00	
		Theta	27 07	45 27 02
	Camp Marcy, Pike lake	Polaris	45 44 26	
June 26	Lake ——	Polaris	45 57 08	
			45 57 07	45 57 07.5
	Wild Rice river	Theta		
	Camp McClelland, Shayenne river	Polaris	46 35 58	
			36 03	46 36 00.5
July 8	Second Shayenne Crossing	Polaris	47 27 36	
			33	47 27 34.5
July 10	Lake Jessie			

LIST OF LATITUDES—Continued.

Date.	Place.	Star observed.	Deduced latitude.	Mean.
			° ′ ″	° ′ ″
July 11		Polaris	47 34 10	
			17	47 34 13.5
July 13	Branch of Jacques river	Polaris	47 41 40	
			41	47 41 40.5
July 16	Camp with Red River train	Polaris	47 51 01	
			50 23	
July 17		Polaris	47 47 21	
			27	47 47 24
July 19		Polaris	47 58 00	
		Altair	57 56	47 58 03.5
July 20		Polaris	48 01 58	
July 21		Polaris	48 02 35	
			02 35	
			48 02 35	
		Altair	48 02 16	48 02 20.5
July 22		Polaris	48 05 42	
			46	
			48 05 44	
		Altair	48 05 45	48 05 44.5
July 24		Polaris	48 12 27	
			34	
			48 12 30.5	
July 30		Polaris	48 29 56	
		Altair	29 39	48 29 47.5
August 4	First camp, Fort Union	Polaris	48 00 22	
		Altair	47 59 36	
			95 59 58	
			47 59 59	
August 5	Second camp, Fort Union		47 59 10	
August 9	Little Muddy river	Polaris	48 06 42	
		Altair	06 54	48 06 48
August 11	Big Muddy river	Polaris	48 09 17	
August 12		Altair	04	48 09 10.5
August 14		Altair	48 09 04	
August 15	Porcupine river	Altair	48 07 54	
August 19	First camp, Milk river	Altair	48 07 15	
August 23	Fourth camp, Milk river	Polaris	48 31 13	
			36	48 31 24
August 24		Polaris	48 27 44	
		Altair	39	48 27 41.5
August 25		Polaris	48 22 14	
		Altair	19	48 22 16.5
August 26		Polaris	48 22 24	
		Altair	09	48 22 21.5
August 27		Altair	48 26 00	

LIST OF LATITUDES—Continued.

Date.	Place.	Star observed.	Deduced latitude.	Mean.
			° ′ ″	° ′ ″
August 29		Polaris	48 33 49	
		Altair	48 33 42	48 33 45.5
August 30		Polaris	48 35 56	
			26	48 35 41
September 2	First camp from Milk river	Polaris	48 30 11	
		Altair	15	48 30 13
September 4		Altair	48 34 16	
September 9	Fort Benton	Polaris	47 49 31	
			34	
			32.5	
		Altair	47 49 43	
			28	47 49 35
	Mean			47 49 34
September 19	Second camp, Sun river	Polaris	47 31 19	
September 20	Crown Butte creek	Polaris	47 22 08	
		Altair	11	47 22 09.5
September 21	Dearborn river	Polaris	47 11 19	
			36	47 11 27.5
September 22	First camp on Blackfoot Fork	Altair	47 02 48	
September 23	Second camp on Blackfoot Fork	Altair	46 56 51	
September 28	St. Mary's river	Polaris	46 46 45	
September 30	St. Mary's village			
September 29		Altair	46 31 00	
September 30		Altair	46 31 00	
			46 31 00	
September 30		Polaris	46 31 02	46 31 01
October 6		Polaris	47 08 43	
October 8	Flathead river	Polaris	47 19 40	
October 9	Camas Plain	Polaris	47 29 07	
			28 42	47 28 54.5
October 16		Altair	47 55 48	
October 20	Pend d'Oreille lake	Theta	48 11 07	
October 21	Mouth of Pack river	Polaris	48 17 23	
October 22		Polaris	48 14 27	
		α Pegasi	40	48 14 33.5
October 29	Camp Washington	Theta	47 44 01	
October 31		α Pegasi	47 25 31	
		Polaris	36	47 25 33.5
November 1		α Pegasi	47 11 28	
		Polaris	31	47 11 29.5
November 2	Peluse river	Polaris	46 53 47	
		α Pegasi	38	46 53 42.5
November 7	Wallah-Wallah river	Theta	46 04 01	

LATITUDES AND LONGITUDES.

Place.	Latitude.	Longitude.
	° ′ ″	° ′ ″
Columbia Barracks	45 36 34	122 39 34.6
Mankas	45 47 57	
Yakolet	45 54 20	
Cha-la-cha	45 56 41	
Spil-yeh	46 01 28	
Noompt-na-mie	46 05 38	
Ne-mine-pal	46 05 15	
Wa-ha-mis	46 01 32	
Che quoss	45 56 00	121 23 11
Hool-hoolse	45 58 48	
First Tahk	45 55 31	
Second Tahk	45 59 32	
Kam-ma-hietas	46 07 54	
Clunas	46 15 42	
Sim-Kwe	46 24 17	
Atahnam	46 29 42	
We-nass	46 44 43	
Ket-tas	47 00 59	
Shil-kantin	47 22 19	
We-nat-shapam	47 28 38	120 37 07
Columbia	47 49 40	
Between Methow and Okinakane	48 04 09	
On Okinakane, near Fort	48 05 29	
Camp in the woods	48 13 52	
On Okinakane river, first camp above Fort	48 32 04	
Do ……… second …… do	48 49 04	
Do ……… third …… do	48 59 35	
Fort Colville	46 36 16	118 4 00
Fort Wallah-Wallah	46 03 46	

Wilkes's Wallah-Wallah longitude, 118° 47′ 45″.

Heights by the barometer on the line of the main train from the Mississippi river to Wallah-Wallah.

Date.		Number of camp.	Place.	Height in feet above the sea.
			Camp Pierce, near Fort Snelling	828
			Camp Davis, on Sauk river	994
June	15	1	Prairie	1,207
	16	2	Second Crossing of Sauk river	1,037
	18	4	Lake Davis	1,454
	19	5	Lake Henry	1,284
	20	6	Lightning lake	1,477
	21	7	Prairie	1,753
	22	8	Prairie	1,557
	23 to 25	9	Pike lake	1,134
	25	10	Elk	1,298
	26	11	Prairie	1,417
	27	12	Poplar lake	1,562
	28	13	Bois de Sioux	1,039
	29	14	Wild Rice river	815
	30	15	Prairie	841
July	1	16	Prairie	1,266
	2 to 4	17	Shayenne river	1,025
	4	18	Maple river	817
	5	19	Maple river	922
	6	20	Prairie lakes	1,367
	7	21	Prairie lakes	1,262
	8 to 10	22	Shayenne river	1,141
	10	23	Of advance party	1,150
	10	24	Lake Jessie	1,260
	11	25	Prairie lake	1,497
	12	26	Prairie lake	1,665
	13	27	James river	1,681

Heights by the Barometer—Continued.

Date.		Number of camp.	Place.	Height in feet above the sea.
July	14	28	Prairie	1,320
	15 to 17	29	Prairie	1,530
	17	30	Shayenne river	1,408
	18	31	Prairie	1,463
	19	32	Prairie lake	1,405
			Elevation above camp 110 feet; distant 15.7 miles.	
	20	33	Prairie lake	1,456
			Elevation above camp 120 feet; distant 4 miles.	
			Depression below camp 34 feet; distant 6 miles.	
	21	34	Prairie lake	1,536
	22	35	Prairie lake	1,762
			Elevation above camp 380 feet, distant 13 miles.	
	24	36	Prairie	1,950
			Elevation above camp 93 feet; distant 5.2 miles.	
			Elevation above camp 122 feet; distant 17.5 miles.	
	25	37	Prairie	1,978
			Elevation above camp 130 feet; distant 7.7 miles.	
	26	38	Prairie lake	2,288
			Summit above camp 218 feet; distant 8 miles.	
	27	39	Prairie lake	2,397
			Depression below camp 193 feet; distant 4 miles.	
			Depression below camp 220 feet; distant 7.4 miles.	
			Depression below camp 89 feet; distant 15.8 miles.	
	28	40	Prairie lake	2,021
			Elevation above camp 86 feet; distant 18.2 miles.	
			Depression below camp 72 feet; distant 20.5 miles.	
	29	41	Prairie lake	1,973
			Elevation above camp 83 feet; distant 3.7 miles.	
			Depression below camp 125 feet; distant 17.2 miles.	
			Elevation above camp 73 feet; distant 20.3 miles.	
	30	42	Prairie lake	2,074
			Elevation above camp 331 feet; distant 7.5 miles.	
			Elevation above camp 134 feet; distant 10.5 miles.	
			Elevation above camp 359 feet; distant 12.2 miles.	
	31	43	Prairie	2,403
			Elevation above camp 98 feet; distant 4.3 miles.	
Aug.	1 to 9	44	Fort Union	2,019
			Bluff above, distant 5.7 miles	2,596
	9	45	Little Muddy river	2,030
	10	46		1,839
			Bluff, distant 43 miles	2,181
	11 to 14	47	Great Muddy river	1,929
			Bluff, distant 2.1 miles	2,332
	14	48	Missouri River valley	2,070
	15	49	Porcupine river	1,960
	16	50	Missouri river	2,084
	17	51	Missouri river	2,089
	18 to 20	52	Milk river	2,205
	20	53	Milk river	2,276
	21	54	Milk river	2,111
	22	55	Milk river	2,120
	23	56	Milk river	2,112
	24	57	Prairie pond	2,223
	25	58	Milk river	2,200
	26	59	Milk river	2,211
			Bluff, distant 7.6 miles	2,675
	27	60	Milk river	2,225
			Bluff, distant, 4.8 miles	2,525
	28	61	Milk river	2,231
	29	62	Milk river	2,250
	30	63	Milk river	2,271
	31 to Sept. 2	64	Milk river	2,301
Sept.	2	65	Branch of Milk river	2,773
	2	66	Branch of Milk river	2,840
			Summit between Missouri and Milk river, distant 17.6 miles	3,026
	4	67	Prairie	2,611
	5	68	Marias river	2,221
			Height of prairie passed over to-day, 4.9 miles	2,491
	6	69	Tanzy river	2,332
			Height of prairie between camp and Fort Benton, 2 miles	2,535

Heights by the Barometer—Continued.

Date.		Number of camp.	Place.	Height in feet above the sea.
Sept.	7		Height of Fort Benton	2,329
	11 to 16	71	Teton river	2,350
	16	72	Teton or Tauzy river	3,105
			Summit towards the Prairie lake, 20.9 miles	3,836
	17	73	Prairie lake	3,558
			Summit towards Sun river, 5.5 miles	3,702
	18	74	Sun river	3,115
	19	75	Sun river	3,169
	20	76	Crown Butte creek	3,669
			High ridge, 5.6 miles	4,235
			Dearborn river crossing, 17.3 miles	3,955
	21	77	Dearborn river	4,091
			Eastward base of ridge or pass, 7.1 miles	4,871
			Summit of pass, 8.5 miles	6,044
			Western base of pass, 8.9 miles	5,448
	22	78	Blackfoot river	4,957
	23	79	Blackfoot river	4,470
	24	80	Blackfoot river	4,350
	26	81	Blackfoot river	3,280
			Distance from camp 6.8 miles	3,361
			Distance from camp 7.7 miles	3,836
			Distance from camp 8.3 miles	3,504
			Distance from camp 9.8 miles	3,975
			Distance from camp 11 miles	3,299
			Distance from camp, 16 miles	3,298
			Distance from camp, 17 miles	3,592
	27	82	Blackfoot river	3,256
			Elevation, 3.2 miles	3,502
			Elevation, 9.3 miles	3,065
	28	83	St. Mary's river	2,868
			Crossing St. Mary's river, 18.3 miles	3,096
	29	84	St. Mary's village	3,284
Oct.	2	85	St. Mary's river	2,777
	3 to 5	86	St. Mary's river	2,868
	5	87	Bitter Root river	2,840
			Elevation, 5.6 miles	3,081
			Elevation, 9.4 miles	3,810
			Elevation above the camp, 87, 13.8 miles	3,920
	6	88	Jocko tributary	2,966
	7	89	Jocko river	2,718
			Flathead River crossing, 10.8 miles	2,424
	8	90		2,367
			Elevation, 9 miles	2,775
			Elevation, 9.5 miles	2,671
	9	91	Camas prairie	3,149
			Summit above prairie, 3.4 miles	3,313
			Descent to river bluff, 9.3 miles	3,036
	10 to 12	92	Clark's fork of Columbia river	2,160
			High Rock, 9.7 miles	2,772
			Point of mountain, 16.7 miles	2,637
	12 to 14	93	Thompson's prairie	2,131
			River level, 12.4 miles	2,140
			High bluff, 16.2 miles	3,069
	15	94	Valley of Clark's fork	2,048
			Elevation, 9.9 miles	2,787
	16	96	Valley of Clark's fork	2,002
			Elevation, 2 miles	2,670
	17	97	Valley of Clark's fork	1,980
	18	98	Summit of mountain	2,886
			Mountain point, 5.8 miles	2,664
	19 to 21	99	Pend d'Oreille lake	1,637
	21	100	Pend d'Oreille lake	1,579
	22	101	Pend d'Oreille lake	1,701
	23 to 25	102	Crossing below lake	1,630
			Summit of Spokane country, 20.5 miles	2,572
	25	103	Spokane prairie	2,182
	26	104		2,179
	27	105		1,304
			Spokane crossing, 4 miles	1,198

Heights by the Barometer—Continued.

Date.		Number of camp.	Place.	Height in feet above the sea.
Oct.	28 to 30	106	Camp Washington	2,133
			Summit after camp Washington, 8.3 miles	2,540
	30	107	Fork of Spokane river	2,374
			Bluff after leaving camp, 10.6 miles	2,360
	31	108	Fork of Peluse river	2,160
Nov.	1	109	Fork of Peluse river	1,542
	2	110	Fork of Peluse river	1,227
			Peluse River crossing, 7.3 miles	960
			Bluff on Snake river, 16.6 miles	1,239
	3 to 5	111	Snake river	354
			Snake River bluff, 1.5 miles	744
			Elevation between Snake and Wallah-Wallah rivers, 8.7 miles	1,614
			Elevation between Snake and Wallah-Wallah rivers, 14.1 miles	1,013
			Elevation between Snake and Wallah-Wallah rivers, 20.7 miles	1,139
			Elevation between Snake and Wallah-Wallah rivers, 23.2 miles	1,740
	5	112	Fork of the Wallah-Wallah river	840
			Prairie towards Wallah-Wallah river, 16 miles	1,085
	6	113	Near Fort Wallah-Wallah	409
			Columbia river bluff, 1.7 miles	522

Memoranda concerning the Meteorological Observations on the Missouri river, by Lieutenant A. J. Donelson.

The barometer used from St. Louis to Fort Pierre was "Green's closed cistern," No. 718. Its error was assumed to be —.050 inch. At Fort Pierre, after a series of readings, it indicated a height of column .050 inch greater than barometer No. 722, which was "Green's open cistern," of glass. The latter barometer was used from Fort Pierre to Fort Union. It was compared in St. Louis with Dr. Engelmann's standard, and its error was —.01 inch.

In the accompanying tables the barometer has been first reduced to the freezing-point; employing for this purpose the tables for barometers with brass scales, then corrected for error, and then for horary variation. For the latter the following scale, kindly furnished by Professor Blodget, and adopted for Fort Union, has been used:

4 a. m.	+0.20	8 a. m.	—.015	1 p. m.	.000	6 p. m.	+.020
5 a. m.	+0.15	9 a. m.	—.025	2 p. m.	+.018	7 p. m. 8 p. m.	+.010 +.000
6 a. m.	.000	10 a. m.	—.040	3 p. m.	+.025	9 p. m.	—.015
7 a. m.	—.010	11 a. m.	—.035	4 p. m.	+.030	10 p. m. 11 p. m.	—.025 —.020
		12 m.	—.008	5 p. m.	+.030	12 p. m.	—.000

Below Fort Union, the variation at 5 p. m. was taken as +.035. The calculation has been made by using the Smithsonian meteorological tables.

The numbers in brackets, in the column of heights, denote the estimated height of the instrument above low water.

The point of reference was the level of the sea where the height of the barometric column would be 30.000 inches, the temperature being 64°.

A constant number, 34.9, has been added to each calculated height.

Table of Barometrical Observations and of Heights and Distances on the Missouri river.

Station.	Date—1853.		Distances.						
	Day.	Hour.	From place to place.	From St. Louis.	Barometer readings.	Attached thermometer.	Open air thermometer.	Corrected barometer.	Elevation above the Gulf of Mexico.
Booneville	May 24	10.10 a. m.	......	214	29.760	65	64	29.573	436.4 (20)
Howard's Landing	24	2.15 p. m.	6	220	29.72	69.5	67	29.582	428.6 (6)
Right bank, eleven miles below Brunswick	25	1.50 p. m.	48	268	29.67	75	70	29.508	501
Left bank, eight miles above Miami	25	7.50 p. m.	29	297	29.60	70	67	29.444	560 (20)
Left bank, six miles above Dover Landing	26	10.20 a. m.	28	325	29.54	70	68.5	29.341	659
Lexington	26	1.15 p. m.	8	333	29.52	80	75	29.324	680 (20)
Right bank, twelve miles above the mouth of the Kanzas	27	11.10 p. m.	79	412	29.43	60	64	29.281	713
Two miles below Fort Leavenworth	28	9.10 a. m.	16	428	29.436	71.5	70.5	29.249	749
Right bank, one mile above Weston	28	12.30 p. m.	9	437	29.394	82	77	29.190	802
Five miles below Columbus Landing	28	9.30 p. m.	23	460	29.206	72	69	29.023	967
St. Joseph	29	2.55 p. m.	20	480					
Two miles below the Little Nemaha	31	3.45 p. m.	88	568	28.984	76.3	73	28.841	1150.2
Sixteen miles above the Little Nemaha	31	12 p. m.	18	586	28.884	67.5	67	28.734	1245
Five miles below Weeping Water river	June 1	8.10 p. m.	22	608	28.81	68.5	67	28.654	1323.5 (20)
Bellevue	2	10.15 p. m.	38	646					
Two miles below the Little Sioux river	5	11.40 a. m.	124	770	28.778	79.5	74	28.584	1402
Blackbird's Hill	7	12.15 a. m.	50	820					
Cedar island, two miles above the foot	14	6.15 p. m.	280	1,100	28.616	82.5	82	28.455	1556 (10)
First range of bluffs, right bank opposite, one-quarter of a mile from river	14	9 p. m.	......	....	28.478	75	75	28.300	1686
Second range, three-quarters of a mile from river	14	9.30 p. m.	......	....	28.434	73.5	73.5	28.260	1723
Third range, one and a half mile from river	14	10.15 p. m.	......	....	27.940	71.5	71.5	27.764	2226
Old Fort George	18	1.45 p. m.	149	1,249					
Fort Pierre at the landing	19	5.30 p. m.	25	1,274	28.558	78	74	28.417	1566.7 (9)
Bluffs, two miles west of Fort Pierre	19	4 p. m.	......	....	28.248	77.5	74.5	28.106	1880
Northeast corner of Fort Pierre, three-quarters of a mile from landing	19	3 p. m.	......	....	28.536	76.5	76	28.390	
Do.......do.......do	20	10 a. m.	......	....	28.502	74.5	70	28.296	1662
Do.......do.......do	20	10.5 a. m.	......	....	28.450	74.5	70	28.294	
Do.......do.......do	20	10.15 a. m.	......	....	28.494	75	71	28.296	
Big Cheyenne river	....	....	42	1,316					
Right bank, thirty miles above Big Cheyenne river	22	12 m.	30	1,346	28.335	69	66	28.214	1757
Grand river	....	....	49½	1,395½					
Wetarhoo river	....	....	24½	1,420					
Cannon-ball river	....	....	80½	1,500½					
Right bank, two miles below Eagle Butte	....	....	18½	1,519					
Heart river	....	....	22	1,541					
Fort Clarke	....	....	48	1,589					
Knife creek	....	....	30	1,619					
Three miles above La Fontaine Rouge	29	10 p. m.	20	1,639	28.240	62	55	28.121	1834 (9)
Fort Berthold	30	5 p. m.	37	1,676	28.200	79	72	28.114	1873
Right bank, three miles below Little Missouri river	30	11.30 p. m.	18	1,694	28.140	59	54	28.044	1907 (10)
Little Missouri river	....	....	3	1,697					
White Earth river	....	....	65	1,762					
Muddy creek	....	....	74	1,836					
Seven miles above Muddy creek	July 3	10 a. m.	7	1,843	28.155	67.8	68	28.005	1974
Mouth of the Yellowstone	....	....	40½	1,883½					
Fort Union....(mean of 62 observations)	....	....	3½	1,887	....	......	72	27.932	2055 (40)
Great Muddy river	....	....	50	1,937					
Poplar river	....	....	52	1,989					
Fifteen miles above the mouth of the Poplar	....	....	15	2,004					

Meteorological Observations at stations on the route.

I.—From register kept by Mr. James Doty, at Fort Benton, Upper Missouri river, latitude 47° 49′ 34″ N. Approximate longitude 110° 35′ W.; approximate elevation 2,329 feet.

Date.	Mean temperatures.				Extreme temperatures.				Remarks.
	7 a. m.	2 p. m.	9 p. m.	Monthly mean.	Upper.	Day and hour.	Lower.	Day and hour.	
1853. October.....	° 47	° 61	° 51	° 53	° 80	17th, 2 p. m.	° 10	23d, 7 a. m.	But a slight quantity of rain fell. Of snow there were 3¼ inches—2½ inches on the 24th, and ¾ inch on the 31st. The general direction of the wind was west-southwest.
November...	12.7	27.5	18	19.4	58	20th, 2 p. m.	—2	5th and 25th, 7 a. m.	Of snow 2⅝ inches fell. The general direction of the wind was north.
December...	27.77	40.94	30.4	33.03	60	8th, 2 p. m.	0	22d, 7 a. m.	Clear weather prevailed. The general direction of the wind was southwest.

II.—From register kept under the direction of Lieutenant John Mullan, United States army, at Cantonment Stevens, Bitter Root valley, Washington Territory. Approximate latitude 46° 19′ 15″ N.; approximate longitude 113° 55′ W.

Date.	Barometer.		Extremes of the barometer before and after reductions to freezing point.				Mean temperatures.			
	Mean height of column.	Mean of reductions to freezing point.	Upper.	Day and hour.	Lower.	Day and hour.	7 a. m.	2 p. m.	9 p. m.	Monthly mean.
Jan., 1854....	26.354	26.360	26.870 reduced 26.956	5th, 7 a. m.	26.020 25.985 25.965 reduced 26.005 26.035 26.015	3d, 7 a. m. 24th, 2 p. m. 24th, 9 p. m.	° 12.10	° 16.87	° 12.82	° 13.93
Feb., 1854....	26.215	26.207	26.570 reduced 26.590	1st, 9 p. m.	25.630 reduced 25.617	11th, 7 a. m.	28	37.15	28.87	31.34
March, 1854...	26.144	26.117	26.480 reduced 26.476	31st, 7 a. m.	25.785 reduced 25.751	10th, 7 a. m.	37.8	46.5	34.2	39.5
April, 1854....	25.962	25.933	26.500 reduced 26.495	1st, 7 a. m.	25.196 reduced 25.089	18th, 2 p. m.	46	58.5	46.9	50.5
May, 1854....	25.976	25.891	26.340 reduced 26.319	9th, 7 a. m.	25.295 reduced 25.212	21st, 7 a. m.	53.2	62.7	49.8	54.8

Meteorological Observations at stations on the route—Continued.

II—Continued.

Date.	Extreme temperatures.				Mean quantity of clouds.			Mean course and velocity of clouds.			Mean direction and force of wind.		
	Upper.	Day and hour.	Lower.	Day and hour.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.
	°		°										
Jan., 1854....	52	31st, 2 p. m.	—29	19th, 9 p. m.	4. 8	6	7	Not recorded in register.			s. 1. 1	sw. 1. 15	sw. 1. 19
Feb., 1854....	46	9th, 2 p. m.	14	3d, 7 a. m.	6. 4	5. 3	4. 7	se. .7	wsw. 1.3	ssw. .4	sw. 5	wsw. 1. 1	s. 5
March, 1854..	61	24th, 2 p. m.	22. 5	1st, 9 p. m. 2d, 7 a. m.	5. 4	6	4	sw. .6	sw. .5	sw. .6	ssw. 9	sw. 1. 5	ssw. 5
April, 1854 ...	74	17th, 18th, 29th, 2 p. m.	31	1st, 7 a. m.	5	5. 7	4. 6	sw. .1	ssw. .5	s. .03	s. 9	wsw. 1. 4	w. 8
May, 1854....	80	21st, 2 p. m.	36	7th, 7 a. m. and 9 p. m.	4. 9	5. 4	4. 6	sse. .16	ssw. .38	w. .03	sse. 6	sw. 1	sw. 3

REMARKS.

January, 1854.—The thermometer at 9 p. m. on the 5th is marked in the register as not readable. There fell about 1 inch of rain, and 7¾ inches of snow.

February, 1854.—There fell about 4½ inches of snow.

March, 1854.—There was a slight fall of snow on the night of the 3d. A snow squall at 3 p. m. on the 6th for a few minutes. Snow from 7 p. m. to 11 p. m on the 7th (1¼ inch.) Squalls of snow at intervals all day on the 8th. Alternate snow and rain all the morning of the 10th. It rained from 3h. 30m. p. m. on the 27th till 8h. 30m. a. m. on the 28th. Occasional showers on the 28th. Squalls of snow and rain at intervals on the 29th. Squalls of snow on the 30th.

April, 1854.—Rain at 6h. 30m. p. m. on the 1st. Rained moderately all the forenoon, and again in the evening, on the 2d. Slight rain on the evening of the 4th. Snow squall at 9 a. m. on the 7th. Shower in the north on the 15th. Occasional showers during afternoon of the 19th. Distant thunder shower on the 20th. Slight rain on the 21st, and slight fall of snow on the night of the 21st. Slight rain at 4h. 30m. p. m. on the 25th.

May, 1854.—Slight thunder shower, with north-northwest wind, on the 2d. Rain at 9 p. m. on the 5th. Raining slightly at intervals all day on the 6th. Raining steadily until 7 p. m., again at 7h. 30m. p. m., with some snow, on the 7th. On the 8th it rained from 8h. 45m. a. m. until 12 m., and there was rain at intervals all the afternoon. On the 13th there was a heavy shower from 3 p. m. until 7h. 30m. p. m., with high east and southeast winds. On the 16th, at 11 p. m., heavy shower for 30 minutes. On the 27th there was slight rain from 8h. 30m. p. m. until 9h. 30m. p. m. On the 28th there was a slight shower at 9 p. m., and snow from 9h. 30m. p. m. until 3 a. m. 29th (1¼ inch.) On the 29th it rained slowly from 5 p. m. until 9 p. m. On the 30th it rained from 10 a. m. until 4 p. m.

Meteorological Observations at stations on the route—Continued.

II.—From register kept under the direction of Lieutenant John Mullan, U. S. A. Determination of the height of Cantonment Stevens.

Barometer.		Mean temperature of the air.	Height.	Remarks.
Mean height of column, 431 observations.	Mean of reductions to the freezing point.			
		°	*Feet.*	
26. 134	26. 102	38. 01	3, 754	The calculation has been made by referring the station to the level of the sea in the same latitude, where it is assumed that the corrected height of the barometrical column is 30 inches, and the temperature of the air 55°. No corrections have been applied except those for the temperatures of the air for the latitude, and for the elevation of the upper barometer. In making the reductions to the freezing point the tables for barometers with brass scales have been used. The barometer employed in the observations was Green's open cistern, which, it is thought, has its scale on glass. The observations were generally taken daily at 7 a. m., 2 p. m., and 9 p. m. The following are, however, wanting, viz: In January, at 7 a. m. on the 1st, 2d, 7th, and 11th; at 2 p. m. on the 1st, 10th, 11th, and 30th; and at 9 p. m. on the 1st, 6th, 10th, and 29th. In February, at 2 p. m. on the 8th, and at 9 p. m. on the 8th and 9th. In April, at 2 p. m. on the 15th and 28th. And in May, at 2 p. m. on the 1st and 20th. The observations, as recorded in the register, at 9 p. m. on the 28th of April and the 14th of May, and at 2 p. m. on the 15th of May, are, respectively, 26.690, 26.900, and 26.880. From the general range of the barometer at the time, it is thought 25.690, 25.900, and 25.880, were intended.

III.—Copied, by permission, from a register kept at Fort Steilacoom, W. T., by Dr. J. M. Haden and Dr. George Suckley, U. S. A., for the medical department.

Date.	Mean temperatures.					Extreme temperatures.				Remarks
	Sunrise.	9 a. m	3 p. m.	9 p. m.	Monthly mean.	Upper.	Day and hour.	Lower.	Day and hour.	
1853.	°	°	°	°	°	°		°		
October…	45. 25	55. 58	62. 32	51. 19	53. 32	78	4th, 3 p. m.	29	23d, sunrise.	There were 6. 93 inches of rain. There was hoar frost three times, and frost once, during the month.
November.	40. 2	46. 7	50. 43	43. 73	44. 63	59	30th, 3 p. m.	27	14th, sunrise.	There were 18. 41 inches of rain. Hoar frost twice; one strong frost.
December.	38. 74	44. 30	51	44. 45	44. 74	60	2d, 3d, & 5th, 3 p. m.	23	20th, sunrise.	There were 4. 42 inches of rain. 1½ inch of snow at sunrise on the 23d. There were hoar frost three times, frost once, and hard frost four times, during the month.
1854.										
January…	24. 64	29. 96	37. 80	30. 03	31. 38	58	2d and 29th, 3 p. m.	−1	22d, sunrise.	There were 8. 69 inches of rain; 2½ inches of snow at sunrise, and ice 1½ inch thick on the 4th. Snow latter part of the 10th; 2¾ inches of snow at sunrise, and snow at intervals, on the 11th. Light showers of snow at intervals on the 12th. Six days when there was frost.

Meteorological Observations at stations on the route—Continued.

III—Continued.

ate.	Mean temperatures.					Extreme temperatures.				Remarks.
	Sunrise.	9 a. m.	3 p. m.	9 p. m.	Monthly mean.	Upper.	Day and hour.	Lower.	Day and hour	
1854.	°	°	°	°	°	°		°		
February..	34.17	39.82	48.17	36.42	43	60	23d, 3 p. m.	22	1st, sunrise	There were 7.57 inches of rain. One-eighth of an inch of snow at sunrise on the 1st. Snow at intervals on the 10th. One-quarter inch of snow at sunrise, and snow at intervals, on the 11th. Snow on the 14th. Hard frost four times, hoar frost twice.
March	35.58	43.58	54.22	40.09	46.08	67	24th, 3 p. m.	28	31st, sunrise.	There were 2.89 inches of rain. Light showers of snow at intervals on the 10th. Showers of hail and snow on the 29th. Two hoar frosts and one hard frost during the month.

IV.—From register kept by Mr. Geo. W. Stevens, at Olympia, Washington Territory; latitude 47° 02′ 50″; approximate longitude 122° 53′ W. Those results, in this table, which were obtained at Fort Steilacoom, have been copied, by permission, from a register kept by Dr. Geo. Suckley, and Dr. Richard Potts, U. S. A., for the medical department U. S. A.

Date.	Mean temperatures.				Extreme temperatures.				Mean quantity of clouds.			Mean course and velocity of clouds.			Mean direction and force of wind.		
	7 A. M.	2 P. M.	9 P. M.	Monthly mean.	Upper.	Day and hour.	Lower.	Day and hour.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.
	°	°	°	°	°		°										
April, 1854......	44.9	57.1	49.6	50.5	73	15th, 2 p. m.	34.5	1st, 2 p. m..	8.3	6.3	4.7	SW., 1	SW., 1.8	SW., .5	SSW., .7	W., 1.7	SW., .3
FORT STEILACOOM.																	
May, 1854.......	....	....	....	56.51	84	19th, 3 p. m.	36	25th, sunrise									
June, 1854,......	...	....	....	61.4	86	19th, 3 p. m.	44	6th, sunrise.									
OLYMPIA.*																	
July, 1854	55	75.9	64	65	89.4	25th, 2 p. m.	45	2d, 7 a. m...	2.9	2.5	0.4	NW., .4	WNW., .5	W., .1	NW., 1.1	NNW., 2	WNW., .9
August, 1854....	55.5	74.2	65.5	65.1	86.5	14th & 15th, 2 p. m.	48	22d, 7 a. m..	5.6	4.4	3	SWW., .6	SW., .6	....	SE., 1	NW., 2	SW., .6
September, 1854	53.1	69	56.9	59.7	84.5	20th, 2 p. m.	44.6	30th, 7 a. m	7.5	5	3.5	SW., .9	W., .9	E., .07	S., 1	NW., 1.7	SW., .6
October, 1854...	45.2	60.2	48.7	51.4	73	4th, 2 p. m..	33	7th, 7 a. m..	6.6	5.7	5	SWW., .6	SW., 1.4	SWW....	SSE., .7	NNW., 1.6	S., .7

* Registers for Olympia for May and June, 1854, not received.

REMARKS.

April, 1854.—"No rain-gauge. The whole month might be called a continuous rain-storm, though there were three or four pleasant evenings. Fair weather was always of very brief duration." "There was a pretty heavy frost on the night of the 7th; rain and hail together for 15 minutes on the 11th; ice, ⅛-inch thick, formed on the night of the 20th; frost on the nights of the 21st and 25th." At Fort Steilacoom, latitude 47° 10′ 57″ N., longitude 122° 33′ W., the quantity of rain during the month was 12.5 inches.

May and June, 1854.—Quantity of rain 0.88-inch. Light "hoar frost" and light frost during May. Quantity of rain in June 5.68 inches.

July, 1854.—"Not a drop of rain during the whole month, except a slight sprinkle at 4½ p. m. on the 15th. At Fort Steilacoom there was 0.35 inch of rain on the 16th, and on the same day there was "hoar frost."

August, 1854.—At Fort Steilacoom there were 3.93 inches of rain, and there were two heavy and two light frosts, during the month.

September, 1854.—At Fort Steilacoom there were 3.46 inches of rain, and there was frost four times, during the month.

October, 1854.—There were 3.14 inches of rain. Five frosts during the month.

REPORT OF GEORGE GIBBS ON A RECONNAISSANCE OF THE COUNTRY LYING UPON SHOALWATER BAY AND PUGET SOUND.

OLYMPIA, WASHINGTON TERRITORY,
March 1, 1854.

SIR: I have herewith the honor to submit the report of the journey undertaken, pursuant to your orders, for the examination of the country lying between Shoalwater bay and Puget sound, as also of a tour through the Sound itself.

This bay, the entrance to which lies about twenty-five miles north of Cape Disappointment, approaches in its southern extremity to within four miles of Baker's bay and fifteen of Gray's harbor. Its length from north to south is by estimate about thirty miles, and its average width eight. The width of the entrance is reported at five miles. It has two channels, both pretty straight; but the northern only a good beating channel. The depth of water on the bar at low tide is three and a half fathoms. The greater part of the bay is bare at low tide, presenting extensive mud flats, so that vessels can approach the shore in but few places. There are three routes used by the Indians, in crossing between the bay and the Columbia river. One of these is by the Wallacut creek at Baker's bay, with a portage of about a mile and a half to another running into Shoalwater bay. Here the land is so low, that it is said a canal, a few hundred yards in length, could easily be made, connecting the waters of the two. There seems a strong probability that Shoalwater bay once formed part of the estuary of the Columbia river, the rocky promontory of Cape Disappointment being an island in its midst, or at least that an actual communication existed between them. A second portage, by which I crossed, leads from the Wappaloche creek, below Chinook Spit, to the Ateesowill, and is about the same length. These creeks are all tide-sloughs, nearly dry at low water. A third is by the Kewitsa, which runs into Gray's bay above Point Ellice, from which there is a portage to the Nasal, a stream emptying into Shoalwater bay some miles from its southern extremity. This last is not much used. For the establishment of any artificial communication, the first-named is preferable.

The peninsula extending north from Cape Disappointment is similar in character to the Clatsop plains, much of it being prairie land; it is, however, deficient in water. On the north a straight beach runs to Gray's harbor. Quite a number of streams empty into Shoalwater bay, of which the principal are the Nasal, (already mentioned,) the Copaluks, and the Willopah. The first two must head in the mountains, near Gray's river. The latter rises in the divide between the waters of the Chihalis and the bay, the main branch probably interlocking with the south fork of that river, in a mountain lying north of Cathlamet. On all these, as well as the smaller streams, there is a good deal of salt-marsh near the mouth, subject to flood in winter. The tide, the extremes of which are about the same as those on the Columbia river at Astoria, (viz: 13 feet,) extends from eight to fifteen miles up those rivers; but vessels could not ascend so far. The country upon the bay is, like most of that in the coast section of the Territory, heavily wooded with fir, spruce, hemlock, and arbor vitæ. Upon the rivers, white and vine maple and alder occur. The timber is good and accessible, but there are few sites for saw-mills. One mill only had been erected at the time of my visit, and that was not yet in operation. A considerable amount of piles and square timber has, however, been shipped to California.

The settlements are as yet, with the exception of a few scattered claims, at the northern end of the bay; and a small village, occupied by fishermen, has grown up near the mouth of the Willopah. The principal trade, so far, has been in oysters, which abound on the flats. They are taken up, during the low tides of summer, from their natural beds, separated, and replanted, as in the States. They sell alongside the vessel at $1 50 per bushel, and in San Francisco are worth $7. The fall salmon, sturgeon, and other kinds of fish, are abundant, and the bay will probably derive a considerable importance from this source. No part of the coast affords a greater field for the naturalist than does this place, in its variety of marine productions and the aquatic birds which visit it during the fall and spring. As regards its geology, the same tertiary formation which exists at the mouth of the Columbia extends here also, and the only rock in place is a sort of argillaceous limestone. There are evidences of comparatively recent changes in the elevation of the land. Between the Copaluks and the Willopah, there is in a high clay bank a stratum of shells—chiefly of oysters and a species of clam, now extinct here, though said to exist elsewhere on the coast. The bed is elevated from three to eight feet above the present level, and is covered with earth in places to the height of thirty feet. A narrow seam of vegetable matter is visible in another place at a similar depth. Logs and stumps of trees protrude from this bank, which is undergoing constant abrasion. At Stony Point there is a stratum of transported boulders of large size, and a layer of gravel containing agates.

The principal object of my journey was to explore the route connecting Shoalwater bay with the interior. An old Indian trail, disused for some years since the extinction of the tribe through whose country it ran, was said to lead from some point on the Willopah, and intersect the road from the Cowlitz Farms to Puget sound. The journey, according to report, took but two days. I found it impossible to obtain Indian guides in consequence of the season—the few remaining on the bay, who had ever travelled it, being unwilling to venture out, and representing the trail as entirely overgrown and difficult to follow. Three of the citizens, however, Messrs. J. L. Brown, Charles Stuart, and Samuel Woodward, volunteered to accompany me, and we concluded at least to make the attempt. On the 17th December we proceeded up the Willopah about fifteen miles in a canoe, and then landing, started on foot, taking with us six days' provisions. The nature of the country not permitting us to follow any divide, we were compelled to travel through the river-bottom, fording the stream occasionally at the bends. Finding, after three days' travel, that we had made but fifteen miles, and being apprehensive that, should we be overtaken by heavy rains or snow, we could neither advance nor return, I thought it prudent to abandon the attempt for the time being, the more especially as we had got hold of the trail, and succeeded in ascertaining the direction of the river, and the character of the country before us.

The general course of the route will be seen by reference to the map. The lower part of the river is bordered with tide-lands, at first open, but affording here and there higher land suitable for grazing. The river is a mile wide at its mouth, narrowing to twenty-five yards, as a general width, beyond the influence of the tides. These extend to the rapids, seventeen miles up, beyond which it is merely a bold stream. At this time it had fallen nearly to the common level; but a few weeks before, it rose sixteen feet after a heavy rain. It is very winding, the banks high on one side and flooded on the other.

From the point where the tide ceased, open fern prairies commence, which are dotted along at intervals for some miles. They vary from thirty to one hundred acres in extent, except the lower one, which is one and a half mile long; the rest is vine-maple bottom, very level, and with a deep, rich soil of clayey character. The maple growth is exceedingly dense and tangled, so much so that passage through it is next to impossible. Some heavy timber of spruce and arbor vitæ is scattered through the bottom, but not in sufficient quantities to render clearing difficult compared with most land in the country.

The general impression obtained is, that the bottom, above the reach of the tides, embraces a tract of twenty by ten miles. But little of this is overflowed, and that only on the margin of the streams. It is well watered. There are no continuous hills in this valley, but occasional spurs, thickly wooded, from the tops of which we made what examination of the country was possible. From the point of our return the range of hills separating the south fork of the Chihalis from the Willopah appeared to be about fifteen miles from us in an easterly direction, bending, however, on our right, considerably west of south, and uniting with those between the latter and the Columbia, where there is apparently a gap.

The only obstacle to a good road connecting the bay with the Cowlitz trail, is evidently this range of hills; and from the information we received from the Indians, as well as our own observations, it would not be a serious one. After crossing the hills it would run almost entirely through prairie. A good stock trail, exclusive of bridges, could be cut through such a country for about $15 per mile; a wagon road complete would cost $50. Several of our crossings could be avoided by keeping a little farther from the river, and points could be selected for bridges beyond the influence of the freshets. It is more than probable that another route would be found, on exploration, to connect by the northern fork of the Willopah with the Satchall, which would still further shorten the communication with Olympia. Of this, however, we had no means of satisfying ourselves at the time.

The proper season for an exploration of this district is at some time during the winter, when not much rain is expected. The Indians recommend February. During the months when the maples are in leaf, it is impossible to see even a few yards in advance. The best course would be for a party of five, packing provisions on a horse, to cut the trail as they go. They can in this way proceed almost as rapidly, and with less fatigue than they could carrying provisions, tools, and blankets, themselves. The amount of open prairie is not sufficient in this valley to afford a stock range, but there is enough for a considerable number of good farms. The salt marshes, too, are available except during the highest tides of winter. But for cultivation, there are very few single tracts in the Territory of equal extent, and of as good quality.

Another route of communication, concerning which I was instructed to make inquiry, was one from some point near the mouth of the Columbia to Olympia, more direct than that by the Cowlitz.

One route which appears probable is by way of Gray's river, a large stream running into Gray's bay, opposite to and a little above Astoria. No attempt has been made to push through an examination of this, as no one has been sufficiently interested to do it; but from the descriptions of persons who have been there to cut timber, it appears to have a valley much resembling that of the Willopah, though narrower, the soil black and rich, and the ground covered with alder and vine-maple. Should this prove practicable, as there is every reason to believe, a road would not only open up to settlement a tract of valuable country, but much shorten the distance between the mouth of the Columbia and the Sound. The tide is said to extend up the river about twenty miles, to a fall of some twelve feet in height. There is a bar at the mouth of Gray's river, but the water inside is sufficient for large boats. Another route, in some respects preferable, is by way of the Elokamin, a stream emptying into the Columbia just below Cathlamet, about twenty-five miles above Astoria. This heads with the south fork of the Chihalis, and in the opinion of Judge Strong, of Cathlamet, is perfectly practicable. It would have this advantage over the Gray's river route, that its terminus would be at a regular landing place of the river steamers, and accessible at all seasons of the year.

The practicability of a good wagon trail from the Willopah to the Cowlitz, is sufficiently established. Its western terminus might be at Woodward's, about thirteen miles from the mouth of the river, to which point small steamboats could run at all seasons; and in surveying it, it would, perhaps, be best to make that the starting point. In laying out a road to the Columbia it would be preferable to begin from the head of the Chihalis, and be governed as to the terminus by the nature of the country. The importance of both these roads is almost too obvious to require comment.

Shoalwater bay has now no communication with the other parts of the Territory, except by the Columbia river or by the Chihalis; both of which routes are circuitous, and, during the rainy season especially, very inconvenient and exposed to serious delays. As the seat of government will probably be at some point on Puget sound, it is essential that a connexion between them should be established, practicable at all seasons, within a reasonable time. And in a military point of view, no less is it essential that so accessible a harbor should not remain without communication with the interior.

The direct land communication between the mouth of the Columbia and the Chihalis country would be of immense advantage to both in opening up settlements, and greatly shorten the mail communication between Astoria and the Sound. From the Cowliz bottom to Cathlamet there is no practicable starting point for such a route, a heavy range of hills bordering the river the whole distance and extending back for some miles. The road must, therefore, necessarily terminate at some point below the latter place.

The course of the Chihalis river is so remarkable as to deserve a particular notice in reference to this part of the country. Heading about fifteen miles north of the Columbia, at Cathlamet, it runs nearly parallel with, but in an opposite direction to, the Cowlitz, and between that river and the heads of those entering the bay, which it completely encircles. After receiving the Nawaukum and the Skookum Chuck, two bold streams rising in the Cascade mountains, it bends to the westward, and empties finally into Gray's harbor. Much of the country upon its borders is open prairie, and that portion lying between the Bois-fort and Mound prairies forms a part of the great level between the Columbia bottom and Puget sound. A range of hills separates it from the Willopah, but between it and the Cowlitz the divide is almost imperceptible. From the Skookum Chuck down, the prairies continue here and there, the lower ones being rather less gravelly than that known as the Mound prairie.

About eighteen miles from the Skookum Chuck it receives a creek from the northward, called the Satchall, heading in a small lake, and thirty miles below that a larger one, the Satsop. Both of these interlock with the Skokomish, running into Hammersly's inlet; or, as it is called here, Skookum bay. The Indians speak of numerous prairies as lying around the heads of those streams. A horse trail, used by them, leads from the Satsop across to the inlet.

Two other considerable branches, both likewise from the north side, enter farther down the Wynoochee and Whiskkah, and a still larger one falls into Gray's harbor, on which, according to them, there is fine prairie country and many horses.

The whole country north of the Chihalis is known only by Indian report.

About twenty-five miles above it lies the Quinaitl. This stream also, according to common accounts, interlocks with the waters of Hammersly's inlet. It has no entrance for vessels at its mouth, and is of inconsiderable size, but the country between it and the former contains large open prairies.

On reaching Olympia, in the beginning of January, I was directed to proceed through the Sound, for the purpose of making inquiries relative to the Indian tribes. The journey being performed by water, and the weather very inclement, no opportunity occurred for exploring the interior; but some information was nevertheless collected incidentally. The country at the head of the Sound is pretty well known, but only a few persons have penetrated that farther to the northward. The whole forms a basin, enclosed between the Cascade and the Coast chains, and is of itself apparently but a portion of one more extended, stretching from the Columbia river far to the north, of which the mountains of Vancouver's and Queen Charlotte's islands are part of the exterior wall. A glance at the map presents in the inlets which pierce the main land opposite those islands, the same geological features that exist upon the Sound. The mountains of the Olympian range evidently, at one time, formed but another island. The prairies lying upon the Cowlitz and the Chihalis were elevated at the same time with the present shores of those arms of the sea, and probably intersected by similar canals. The wash of the mountains has filled these up, just as the same process of deposition has shoaled the heads of existing inlets, and created the extensive marshes and flats lying between Whidby's island and the main.

The general face of the country upon the Sound is that of a slightly rolling plateau, the elevation of which is from one hundred to three hundred feet, rising, however, as it approaches the foot of the mountains. The banks are usually bluff, formed of sand, gravel, and boulders, with a slight admixture of clay, and resting on a substratum of stiff blue clay. Elsewhere the sand is replaced by sandstone, containing lignite and coal. The soil at the head of the Sound is for the most part gravelly, a character which it takes at the Skookum Chuck river, and retains as far as the Puyallup. Lower down it is clay, of a light grayish color. The gravelly lands bear pretty good grass, but on being broken up the mould leaches through.

It is on these gravelly prairies lying between Olympia and the Skookum Chuck that the mounds occur mentioned by Captain Wilkes, and which he ascribes to an artificial origin. Without commenting upon the improbability of any savage race covering with these monuments so extensive a tract of country, it may be proper to mention that, after a very careful examination, I have failed to discover any regularity in their arrangement, as he imagined, and that the supposed pavement appears to consist merely of the larger stones left by water-courses. It is, indeed, difficult to account for the occurrence, over so large a tract of country, of mounds so uniform in shape and size, and so equally distributed; but the same appearance upon a smaller scale is noticeable elsewhere, and the explanation I believe to be the protection afforded by scattered bushes, roots, or grass to the particular spots constituting their summits, while the adjacent ground has gradually been washed away. In a soil so loose and easily abraded as these prairies, such an effect is not unusual; and I have seen the process going on with individual mounds. A plant fully capable of producing the result is the wild cucumber vine, whose root, sometimes reaching the size of a flour-barrel, would constitute no small nucleus of itself. Much of them is prairie, partially wooded with oak. As farming lands, they are inferior. The clay lands are esteemed excellent for wheat, but some time must elapse before they are extensively cleared. The width of the plateau, from the Sound to the foot of the mountains at Nisqually, is estimated at thirty miles; to the northward it becomes much narrower. The peninsula between Hood's canal and Admiralty inlet, and Whidby's island, partake of this general character.

The Cascade mountains north of Mount Rainier present, from the Sound, the same difference from the southern, in the character of the scenery, as that noticed on the eastern side, arising from a difference in geological character. Seen from the lower end of Whidby's island, the more distant range is a bare and ragged sierra, some of the peaks of which rise to the limits of perpetual snow. Mount Baker, which terminates the view, has a sharp and precipitous outline, more resembling that of Mount Hood than the regular forms of Rainier, St. Helens, and Adams. The fact of an interior mountain basin, inferred during the examination of the country on the Okinakane, seems to be confirmed. Into this there appears to be a wide entrance through the gap of the Samish river. Mount Baker, it should be mentioned, has, during this winter, been in action, throwing out light clouds of smoke. The last eruption of any note is said to have been in 1843, when a slight shock of an earthquake was felt at Fort Langley.

As regards the western side of the Sound, the best information attainable is as follows:

That there is a valley lying to the west of Hood's canal, there seems to be no doubt; and the existence within it of prairie country and small lakes is reported, but no persons now living on the Sound have visited it. A high range of hills extends along the western edge of the canal as far as the head of Quul-seet or Colseed inlet, where it appears to drop off. It closely approaches the water, and, as is said, leaves no passage for a road between. Beyond this range is another higher one, which is believed to extend as far north as near the head of Port Discovery, and thence follow the Straits of Fuca towards Cape Flattery. Still farther west is the main Olympian range, which meets it at that point. Between the first and second ranges there would seem to be a continuous valley, extending from the Chihalis to Port Townsend, and drained at its southern extremity by a branch of the Skokomish, which runs into Hood's canal. Between the second and third, if the description is correct, there must also be a basin, probably a mountainous and broken one, drained at its southern extremity by a branch of the Quinaitl, and at its northern, perhaps, by the Elk-whah, which runs into the Straits of Fuca. Vague Indian rumor mentions a large lake in this basin. It seems highly probable that a good route could be found by the valley first mentioned from Olympia to Port Townsend. As seen from either end the gap is apparently continuous. No obstruction exists to roads from Port Ludlow, at the head of Hood's canal, to Port Townsend, and thence along the straits, except the timber; and an old Indian trail is reported to exist from Suquamish harbor to Port Townsend. The country in the peninsula between the canal and Admiralty inlet being of a general level, Olympia can readily be connected with Port Gamble.

The mountains lying between Hood's canal and the ocean, to the whole of which the name of Olympic range has been given, are of perhaps greater average height than the Cascades, excluding the Snow Peaks. Some of them rise into the snow limit, as the principal point called Mount Olympus, the height of which Captain Wilkes gives as 8,138 feet. This, however, is not like the Snow Peaks of the Cascades, distinct and alone above the rest, but is hardly distinguishable from the mass of mountains around; nor does it present the appearance of having formerly been, like them, a volcano.

A geographical survey of this part of the country is very much to be desired, with a view of developing its agricultural resources as well as its topography. The emigrant has no time or means to conduct explorations, nor does he often know in what direction to extend them. He runs considerable risk, too, in venturing alone, or with but one or two companions, among the coast tribes, and his information when obtained is generally confined to himself. A survey could be conducted with most advantage by a party of about ten, whose labor would be chiefly performed on foot, or with an occasional resort to canoes. The principal streams entering these waters from the east, commencing at this point, are the following: the Stehchass, commonly called the Chutes or Falls river, a bold stream which rises in the lower hills of the Cascades, and empties into the head of Budd's inlet at Olympia, near which town there are falls affording fine water-power.

The Nisqually, a somewhat larger river, rises, as is supposed, in the range between Mount Rainier and St. Helens, and empties into Puget sound proper, or the southern extremity of the main inlet, and a little above the fort.

The Puyallup, believed by Dr. Tolmie, the chief factor of the Hudson's Bay Company at Nisqually, to head on the south side of Mount Rainier, and empty into Commencement bay.

The D'Wamish enters Elliott bay above the town of Seattle. It has two principal forks—the main, or southern, called by the Indians, at different points in its course, St'Kamish and Smalh-ko, and by the settlers White river, from the color of its waters; and the northern, called Green river. The first rises on the eastern side of Mount Rainier, and turns northward around it, receiving the waters of the latter, which heads with the Nahchess, and flows nearly west. Mount Rainier, it should be observed, stands on the western verge of the Cascade range. The emigrant road located the last summer, after ascending the north fork of the Nahchess to its source, crosses the summit to Green river, which it descends to its mouth, and then follows White river to the plains, where it leaves it, crossing the Puyallup and running to Steilacoom. Both these streams, as well as the Nisqually, run in very deep bottoms, cut through the clay and gravel of the plains, and with steep bluffs on either side. A remarkable circumstance connected with the D'Wamish is, that at the western termination of these bluffs a large body of water breaks from it, through a tract of low country, and enters the Puyallup near its mouth. This canal, called by the Indians "Stuck," is about twenty yards wide, deep and rapid.

The D'Wamish river receives another tributary about thirteen miles from its mouth, in the outlet to a lake said to be fifteen or twenty miles in length, and six in its greatest width. This lake approaches to within a mile and two-thirds of the bay, near the town of Seattle, and, as is supposed, eight miles of the Snohomish river, and has a general course nearly parallel with the Sound. An Indian trail leads from it to the Snoqualme falls, passing another small lake in its route. The outlet of D'Wamish lake is about four miles in length, and affords an excellent water-power, which has been improved in the erection of a saw-mill. Upon this outlet a bed of coal has been opened, which will be referred to hereafter.

The tide extends up the D'Wamish to the mouth of the lake fork, sufficiently to check the current in the flood at ordinary stages. The width of the stream is about one hundred yards, as an average. The immediate banks are generally low, skirted with willow, alder, and vine-maple, and a few cotton-woods and white maple, of large size, intermixed. Back from the stream the timber is fir, spruce, and cedar, the last becoming more prevalent in receding from the salt water. The soil is unquestionably good, but the extent of the bottom could not be ascertained from the river. It is said to be considerable. Claims are being rapidly taken up along its margin, and it promises to become one of the most important districts on the Sound. The Indians report numerous small prairies of good land lying at the foot of the mountains, between the heads of this and the adjacent rivers.

The Sinahomish, which is next north of the D'Wamish, empties at Port Gardner, opposite the upper end of Whidby's island. Of its several forks, the southern or Snoqualme heads in the Cascades, a short distance north of the main Yakima Pass; another, the Skywhamish, probably interlocking with the sources of Chelann lake, and the Winatshapam. A more particular description is unnecessary here, as it already enters into another report of the expedition.

Beyond the Sinahomish very little is known of the rivers beyond a few miles from their mouths, except what has been learned from Indians. The next in order—the Stoluckwamish, or, as it is more commonly called, Steilaquamish—empties into the shallow sound above Port Susan, and opposite the head of McDonough's island. It has two main forks, one of which approaches so near the Skywhamish that the Indians carry their canoes across. Below this is the Skagit, of which the Kikiallis is only one mouth. It is a considerable stream, and, as is ascertained, heads in the main range of the Cascades, cutting through that which follows more nearly the coast of the Sound, and empties opposite the northern or lower end of Whidby's island. Beyond this are the Sina-ah-mish, opposite Perry's island, and the Sa-mish, nearly opposite Hornet's harbor.

A considerable stream, the outlet of a lake, falls into Bellingham bay. This, which is called Whatcom lake, is said by Mr. Kelly, a citizen who explored it, to be from twelve to fifteen miles in length, lying northeast and southwest, and is very deep. Two streams, of no great size, enter it. Its level is supposed to be one hundred and fifty feet above the bay, and there are numerous falls in the outlet, the highest about thirty feet. Its mouth affords a very fine water-power, on which a saw-mill has been erected. The lake is bounded on the east and west by high hills, but a valley extends northward towards the Nooksahk and Frazer's river, and but a low divide separates it from the Samish on the south.

The Lummi river falls into the northern end of Bellingham bay. Of this the main branch, called the Nooksahk, is said to head east and south of Mount Baker, and almost to encircle it. Dr. R. M. Bigelow, of Seattle, informs me that he ascended this river to a considerable distance, and that it is a deep and rapid stream, about double the size of the D'Wamish. There is a delta of low land where it and the Lummi unite.

It appears from a sketch of the country between the Okinakane lake and Frazer's river, obtained from Mr. Alexander C. Anderson, formerly of the Hudson's Bay Company, since the construction of the survey map, that this river heads with the Mila-kite-kwu branch of the Okinakane, in the main divide of the Cascades. Mr. Anderson was the first to explore the Hudson's Bay Company's trail from the Okinakane to Fort Langley, and he crossed from that branch on to the Nooksahk, and thence over to a southerly branch of Frazer's river. I have already forwarded his map, which will add much to the geography of the northern part of the Cascade mountains, and which it is to be regretted was not sooner received. Another stream, the entrance of which is said to be accessible to vessels, enters the Gulf of Georgia above Birch bay. It cannot be of great length, as it is cut off by others from the mountains.

None of these rivers, it would appear, run directly from the mountains towards the Sound; but in every instance, so far as known, from northeast to southwest, forming oblique valleys, much longer and with a more gradual descent than would otherwise have been the case; while those on the opposite side of the range run from northwest to southeast. Most of them bring down considerable bodies of water throughout the year, and all, as may be supposed, swell greatly during heavy rains, or the melting of snow in the Cascades. Their course is rapid, and none of them can be considered as navigable even for short distances, though vessels can enter some of the larger. They all have deltas of low land at their mouths, and generally several channels.

As it was a matter of importance to ascertain the most practicable routes for interior land travel from Olympia to Bellingham bay and the Straits of Fuca, such inquiries were made of settlers and Indians as occasion permitted. As regards the country on the upper part of the Sound, no difficulty whatever occurs. The only question respecting the eastern side is the extension of a road northward from the emigrant trail.

It appears that a depression in the country exists for at least a portion of the distance near the western base of the Cascade range, and parallel with it, constituting a lateral valley, crossing the smaller tributaries at a right-angle; and it is probable that this will be found to afford a route. The Indians state that they have a short portage for their canoes from the Skywhamish, a branch of the Sinahomish, across to the south fork of the Stoluckwamish, and another from the north fork of the latter to the Sah-kee-me-hu branch of the Skagit. No information was obtained of the country between the Skagit and the Samish; but so far as the apparent disposition of the mountains is visible from the water, there is reason to believe that the same depression continues northward, and there is no doubt that from the Samish river, by way of Whatcom lake, and crossing the Nooksahk, a good trail can be carried to Frazer's river. It is even said that the Indians have taken horses through the whole distance.

The country north of Bellingham bay appears to be level as far as the range beyond the stream.

I visited the coal-beds on the D'Wamish and at Bellingham bay, but had no time for making more than a very superficial examination. That on the outlet of D'Wamish lake is situated immediately upon the water, a few rods below Tobin & Co.'s mills, and about a mile from the lake. The outcrop is exposed to the eastward or river side, and dips to the water at an angle of about 15°, being broken off towards the north by a fault. The total depth of the bed, including shale, is 13 feet, with 6½ feet of workable coal, divided by a thin seam of fire-clay. The drift had been carried in only about 75 feet. The coal appears to be of good quality, and to burn well with a strong flame, leaving no slag. It is considerably laminated, and has a tolerably bright fracture. The indications are said to continue westward for a considerable distance. Another bed has been discovered lower down, on the main D'Wamish, at Stevenson's claim. It is intended to transport this coal in scows to the town of Seattle, about sixteen miles distant by water.

Two beds had been opened at Bellingham bay, and the coal was visible in the immediate bank for a long distance. The beds are from 2 to 16 feet thick, and dip to the north at angles ranging from 19 to 37 degrees. The overlying rock is a light-colored yellowish sandstone, containing pebbles and concretions of clay. No associated fossils were seen. The shales are very thin as far as noticed, and limestones entirely wanting. Some of the outcrops of coal appear to be at the edge of faults, but the thickness of the formation itself was not examined. The seam which had been most worked—that known as the Ma-moosic mine—was altogether eight feet through, but divided by three feet of clay and slate, leaving only an equal amount of workable coal. A drift had been carried in about 175 feet, the quality improving somewhat. The superior seams at this place did not appear to be worth working. About 150 tons only had been got out, which was mostly on board a vessel bound to San Francisco.

Another bed, a little to the north of this, belonging to Capt. Fauntleroy and others, presented much better indications. Its thickness is sixteen feet four inches, and the coal brighter and freer from impurities than the other. A small quantity got out here sold in San Francisco for $23 per ton. A bed of nearly equal depth is said also to have been since found in the southern part of the bay. Other beds have been found on Samish bay, and Mr. H. A. Goldsborough saw it upon the Stoluckwamish in workable seams, but not accessible to water transportation. The coal at Bellingham bay must be lightered on board of vessels, the water being shallow to a considerable distance from the shore.

The whole of this formation has been considered by geologists as tertiary, and the coal as not belonging to the true coal. Be this as it may, its value for economical purposes is unquestionable. Even that on the Cowlitz and Skookum Chuck, though inferior to the product of the D'Wamish and Bellingham bay mines, was abandoned only from its not being accessible to tide-water.

A singular circumstance in connexion with this subject has been noticed at the southern end of Whidby's island. A crevice in the earth exists there from which smoke constantly ascends, rising undoubtedly from the burning of a bed of coal or lignite beneath. The clay around its edge is said to be baked of a brick-red. It has been burning since the settlement of the country, and is popularly called a volcano.

No scientific exploration whatever has been made of this region, nor even such an examination of particular beds as to justify any opinion respecting their value. Such experiments as have been tried indicate, that for steaming purpose the quality of the coal is very good, but to what extent the beds can be worked is not settled. They appear on the edge of the water, most of them not above the high tides of winter, and it would seem that they dip slightly in-shore, as well as in a direction parallel to it. From the appearance of upturned edges of sandstone, between high and low-water mark, it is conjectured that the coal extends beneath the surface ot the bay; and that to the north of it, it will be perhaps found in place and in the natural position of the strata. The formation commences at the Columbia river, where lignite or brown coal is found in thin seams, and extends continuously northward to a great distance, the quality of the coal improving in that direction. The most northern point, it is believed, where any discoveries have been made, is at Beaver harbor or Port Rupert, on the northern extremity of Vancouver's island. What was obtained here was merely surface coal, and was cut out by Indians with hatchets. The company have now sunk a shaft at Nimo, on the eastern shore of the island, in latitude 49° 09′, longitude 123° 56′, whence they obtain supplies for their steamers. The Beaver harbor locality was abandoned as too inconvenient.

I have the honor to be, sir, your obedient servant,

GEORGE GIBBS.

Capt. G. B. McClellan, *U. S. Corps of Engineers,*
Commanding Western Division N. P. Railroad Exp. and Survey.

REPORT OF GEORGE GIBBS UPON THE GEOLOGY OF THE CENTRAL PORTION OF WASHINGTON TERRITORY.

Olympia, Washington Territory,
May 1, 1854.

Sir: Herewith I have the honor to submit a report on the geological structure of the country lying upon the route of the expedition under your command. It is much less in detail than could have been desired, as the subject itself was subsidiary to others, and the observations were necessarily for the most part confined to general features. Specimens of soils and of the prevailing rocks were collected, which by order of Gov. Stevens, will be turned over to Dr. John Evans.

The country around Vancouver, and thence back to the foot of the mountains, is gravelly and poor, except that on some of the small streams there are narrow skirts of rich black soil. The small prairies lying near the branches of the Cathlapoot'l are, however, exceptions. These appear to have been formerly the beds of lakes, and retain, to some extent, a wet and marshy character, the soil being clay. The Columbia bottom below Vancouver is of a fine, sandy loam. Much of that on the immediate banks of the river is subject to overflow during the freshets—a double misfortune, as the deposits of the Columbia are not fertilizing, and the temperature of the water destroys growing crops. Wheat does not fill after being submerged. Behind this river-belt, the upland is well watered and fertile. The gravelly country back of Vancouver is speedily exhausted, two crops of wheat being as much as it will produce to advantage. The Indians raise excellent potatoes on the Yahkohtl and Chalacha prairies; and wheat would undoubtedly thrive there; but they are subject to summer frosts.

The timber upon the lower lands of the Columbia is chiefly cotton-wood; on the smaller streams, vine-maple and alder; while the upland is covered with the usual growth of the coast region of Oregon—fir, spruce, and, towards the mountains, arbor vitæ. This forest is almost entirely of secondary growth, and is deadened over a vast tract by the fires which run through the country. The fires would seem to add but little to the fertility of the soil, as the trees when consumed have hardly any ashes, and the roots burning out beneath the soil destroys all vegetable decomposition. The succession of forest which so universally takes place in the Atlantic States does not occur here, the few deciduous trees of the country being such as grow only upon the water-courses. As a consequence, the firs almost invariably spring up again when burnt off. The underbrush, consisting of hazel, spiræa, &c., is usually dense. In some isolated tracts the primitive forest remains, and the body of timber is heavy, though much less so than upon the Cascades south of the Columbia.

The first rock in place encountered after leaving Vancouver was near the Yahkohtl fork of the Cathlapoot'l river, and was a hard and dark-green hornblende, without noticeable strike or inclination to the beds. This rock forms the cañon of the stream and prevails to the Cathlapoot'l itself. Boulders of trachyte accompanied the sand and gravel in the Yahkohtl, but not in such quantity or variety as in the main fork which heads in Mt. St. Helens. The divide between the latter and the Columbia is about 1,800 feet in height, presenting a steep and almost precipitous face to the north. The hornblende rock is said to extend down the Cathlapoot'l to within a few miles of its mouth. Sandstone of volcanic origin appeared in large masses on the borders of the river, and probably occurs in place at no great distance. The boulders in its bed are chiefly trachyte of different shades, and basalt, varying from scoriaceous to compact, and very fine grained. There is but little valley on its upper waters, and that of no value, as the soil consists almost entirely of the detritus of these rocks. As might be supposed from its draining the southern and eastern slopes of Mt. St. Helens, the river bears evidence of its great volume during the melting of the snows.

On the north bank of the Cathlapoot'l, and about four miles below the mouth of the Noomptnamie, we crossed a field of lava apparently formed by a stream from St. Helens. Its surface was everywhere broken into mounds, or gigantic bubbles, produced apparently by the expansion of contained gases, or perhaps the moisture of the soil over which it had flowed. These mounds, which were generally of an ovoid shape, varied in size from six or eight feet to a hundred in length, and in some cases rose to twenty and thirty feet in height. Their tops were broken into fissures, the principal corresponding with the longer axis. The direction of this was not uniform, but in the larger seemed to agree with what is supposed to have been the course of the current. The edges of the fissures were perfectly sharp, indicating that the lava had at least partially cooled before fracture; but, on the other hand, quantities of loose clinkers lay upon the sides of the mounds, and small waves produced by the progression of the lava were visible, which seemed to diverge from them. Flat slabs, resembling flags, two or three feet long and a couple of inches thick, also occurred. The surface was vessicular, the inferior portions as seen through the fissures more compact; its depth was not determined. The field had been covered with forest, which, like much of that on the route, had been burnt over. Unfortunately, time did not admit of a visit to the river to examine the termination of the stream, nor yet to the bluffs on the left, to ascertain if the lava underlaid them. These bluffs, extending in a line with the river for some distance, were in places three or four hundred feet in height, composed of sand and boulders of trachyte. The width of this field was about one-third of a mile. A bed of fine volcanic ashes covered the ground for some hundred yards beyond it, and pumice was occasionally found along the route. This is supposed to be the most recent lava ejected from St. Helens.

Leaving the Cathlapoot'l, we commenced the ascent of the Cascade range. The eastern side of the valley rises in high tables, with level tops and steep banks, which are continued to the summit. Unfortunately, we could obtain no view of the country, the smoke from the burning timber, which had prevailed for some days, effectually obscuring the atmosphere. The rock in place was a gray feldspathic trap, covered on the surface with a whitish coating. Large, loose blocks of the same and of trachyte were scattered around. Basalt prevails upon the summit, and forms turrets and pinnacles on some of the heights around St. Helens and Mount Adams. Elsewhere the hills are covered with reddish scoria. One field of lava was passed, fractured in the same manner as that on the Cathlapoot'l, but apparently of older date, and assuming columnar forms, which was not the case with the latter.

The height of Chequoss where the party encamped from the 8th to the 10th of August was 4,053 feet. It is a circular basin, containing a small pond. one of a number lying at the head of the White Salmon river, and presenting the appearance of an ancient crater. Notwithstanding its elevation, this spot is tolerably fertile; the basin, as well as the hills around it, being covered with grass and producing strawberries in profusion, which were in season at the time of our visit. The soil of the mountains is a yellowish loam, except where colored by the decomposition of scoria. The character of the forest changes entirely with the summit of the Cascades. The details of this change belong to another report, but it is proper to refer to it in connexion with the geological face of the country. The arbor vitæ does not cross the dividing ridge; the firs and spruces are speedily lost, and succeeded at first by intermixed larches and pines, and lower down by the pine alone. The larch seems to be confined altogether to the eastern side of the mountains, and the long-leaved pines nearly so. The limit of the firs on the eastern slope would seem to be not far from three thousand feet above the Columbia. The forest retains a considerable size to nearly four thousand feet.

During our stay at Chequoss the weather was only at intervals clear enough to afford a view of the mountains; with the exception of the great snow-peaks, their aspect is that of a chaos of hills, of very equal height, rising from an elevated plateau, but few points rising to a greater elevation than 5,000 feet, which is about that of the snow-line on Mount Adams. No ranges of any great length were distinguishable; the sides of the hills were long, sweeping slopes, enclosing shallow valleys which extend to the very feet of Mounts St. Helens and Adams, and some of which contain marshy prairies, the beds of ponds. The range in this part appears to be about thirty miles in width at the base and fifteen on the top, the steepest slope being to the west. From the hills around Chequoss, the five snow-peaks—Mounts Hood, Jefferson, St. Helens, Adams, and Rainier—were visible, Mounts Hood and Jefferson bearing southwesterly; Mount St. Helens nearly northwest; Mount Rainier a little west of north, and Mount Adams north. The latter was not more than fifteen or twenty miles distant. The height of Mount Rainier, as given by Captain Wilkes, is 12,330 feet, and that of St. Helens 9,550; from which last Mount Adams does not apparently vary much. It is not a little singular that neither Lewis and Clark, nor Lieut. Wilkes, distinguished Mount Adams as a separate peak from St. Helens; for, although they resemble each other considerably in general form, their positions and range are very different. Mount Adams alone is visible from the Dalles; but both of them, as well as Rainier, can be seen from a slight elevation at the mouth of the Willamette. The sketches of Lieut. Duncan, accompanying the reports, will better convey an idea of these mountains than a mere verbal description. The angle of incidence of their sides was taken by a clinometer. The steepest continuous face of St. Helens, disregarding precipices, was about 40°, and none of the others exhibit a greater declivity. The crater of Mount Hood is on its south side; that of Mount St. Helens on the northwest, and of Mount Adams apparently on the east; that of Rainier seems to have been at the summit. Smoke was distinctly seen issuing from St. Helens during our journey.

This and Mount Baker are the only volcanoes at present active in the chain. Its last considerable eruption was in 1842, when it covered the country as far as Vancouver and the Dalles with ashes, and presented a luminous appearance after the smoke had cleared off. The Indians report that there were once three mountains that smoked always, Mount Hood and Mount Adams being the others. Respecting Mounts Hood and St. Helens, they have a characteristic tale to the effect that they were man and wife; that they finally quarrelled and threw fire at one another, and that St. Helens was the victor; since when Mount Hood has been afraid, while St. Helens, having a stout heart, still burns. In some versions this story is connected with the slide which formed the Cascades of the Columbia, and by damming up the water inundated the forest, the remains of which are now visible along its margin. The date of this event Lewis and Clark fixed at about thirty years before their arrival. It is very probable that it may have been due to an earthquake, as they, though not frequent, are known upon the coast. The Indians have no tradition of an eruption of lava; they have only seen smoke and ashes come out of the mountain. They add that a bad smell came from it, and that the fish in the streams died. Around the foot of St. Helens, they say, the ashes lie so deep and soft that horses cannot travel. The state of the weather, and the more urgent business of the survey, prevented an attempt to ascend either of the mountains.

The descent of the Cascade range to the east is far more gradual than on the western side, and the slope comparatively uninterrupted. About four miles from Chequoss, and probably seven hundred feet below it, there is another lava field, broken up into mounds like the two former. We found on its verge a small lake of irregular form, and occupying, when full, about one hundred acres, but at the time very low. It is sunk a few feet beneath the general surface; is shallow, and the water clear and cold. There was no visible outlet, nor any motion indicating a sink, though it received three brooks, one of them fifteen feet across. At the lower end large piles of drift-wood, including trees two and three feet in diameter, had been washed on to the field to the height of some twenty feet at the point of escape during freshets. It was somewhat remarkable that this pond was surrounded by gigantic cotton-wood trees, though the elevation was not less than three thousand three hundred feet. One of the party, who had passed through the woods between the lake and Mount Adams, reported that the lava did not extend in that direction; but whether this arose from its being overlaid with soil, or from having some other source, could not be decided without further examination. The country being covered with burnt forest and underbrush, this was not easy to make. The lake itself was evidently not the crater from which it flowed. Its course would seem to have been from that mountain and towards the Columbia through the valley of the White Salmon, as a dividing ridge separates it from the Klikatat river to the east. The lava here, and generally upon the eastern slope of the mountains, appeared much older than that upon the Cathlapoot'l, the sharpness of fracture being lost, and the surface being more decomposed. Leaving the waters of the White Salmon and crossing a dividing ridge, the trail descended to the Klikatat, a larger stream, heading on the east side of Mount Adams, and, like the last, emptying into the Columbia between the Dalles and the Cascades. Here we met another field of lava, through which ran a line of openings caused by the falling in of the rock covering a vaulted passage. Though dry at the time of our journey, this is evidently during the winter the bed of a torrent which runs towards the Klikatat. Apparently the lava, in overflowing the original bed, had come in contact with sufficient moisture to elevate without rupturing it. The upper stratum was about eighteen inches thick, and regularly arched; its semi-columnar structure giving it the appearance of keyed joints. The lower were more or less distorted, and varied from a few inches to several feet in thickness. They differ also in structure, being much more compact. All of them exhibited a large proportion of feldspar, which seems to be the characteristic of those streams supposed to be traceable to these two mountains, as distinguished from the basalt of the plains. The roof of this passage was broken through at short intervals, and large masses had fallen from the inferior layers of what remained, showing that the work of destruction was still going on. The bed of the water-course was about twenty-five feet beneath the surface, and the vaults were from twenty-five to thirty feet wide, and fifteen or twenty in height. The *under side* of the strata occasionally exhibited fluxures, resembling waves of progression. Small stalactites of infiltration hung from the roof and walls, and stalagmites had been deposited on the floor. This remarkable passage was traced at intervals for three or four miles, and probably terminates in a branch of the Klikatat river crossed by the party the next day. The Indian guide obtained snow from some cavity in this field, and reported that there was one hole into which, if a stone was dropped, a long time elapsed before it was heard to strike.

The soil of the valley which we descended consisted of a yellowish, light sandy loam, for the most part thin, and lying directly upon the basalt. Lower down the mountain it became deeper, and on the banks of the streams showed a depth of six or eight feet. Below the limit of the firs the forest was open, and the ground covered with an abundant growth of excellent grass, forming a good stock-range during the summer season. It is believed that wheat would flourish here; but the general want of water, except on the streams, and the coldness of the climate, will probably prevent its occupation except for grazing. With this branch of the Klikatat river a further change occurs in the rock, the range of hills lying to the east of it consisting of the same gray trap noticed in the ascent from the Cathlapoot'l, and, it would seem, bounding the efflux from the mountains in this direction. From the cursory observations of this journey, it is inferred that the more recent lava from these sources is confined within a particular basin, separated by well-defined boundaries from the basalt of the prairies, from which it differs considerably in apparent structure, and probably in composition also. Should a thorough geological exploration of this region be hereafter undertaken, it will prove a matter of interest to trace up the course of the streams, and fix the true relations of the existing volcanic peaks to these formations.

Between the branches of the Klikatat is the Tahk prairie, the waters of which communicate with the main river. It is about six miles in length, by a mile in its greatest width, and is 1,268 feet above Vancouver. A shallow, marshy lake occupies its lower end, the remains of one which formerly covered the whole and extended much beyond the present bounds of the open land. It is a favorite kamas and wappatoo ground of the Indians. The soil is a bluish clay, baking very hard and cracking in the sun, and forms a great contrast with that bordering it, which is light and pulverulent, and deeply colored by oxide of iron. The dark hornblende rock first noticed on the Yakohtl occurred in place again here, but much more impregnated with iron. The hills are barren and covered with scattered blocks. The main Klikatat river we found running in a bed about two hundred feet below the general surface. It was at this season (August 13) thirty or forty yards wide, and up to the flanks of the horses, with a pretty swift current. Its advantages for lumbering deserve particular attention. The yellow pine is found in abundance, of excellent quality and suitable size, everywhere upon its banks, and logs can be run at any season of the year without much difficulty to the Columbia. This river heads in Mount Adams. The boulders in its bed resemble in every respect those found in the Cathlapoot'l. Its intersection with the trail is the lowest point touched by the main party from the time of leaving the Cathlapoot'l to that of reaching the Columbia below the Pisquouse. The descent of the Cascade range may be considered as terminating here, and the survey of its eastern slope to have commenced.

The Sahpenis, the first branch of the Yakima encountered upon the route, appears also to head in Mount Adams. It is divided from the Klikatat by a range of hills rising to the height of 3,600 feet, and its bed, though in a very deep cañon, is much more elevated than that of the Klikatat. The walls of this ravine are basaltic precipices rising in steps. The country here first begins to open, exhibiting bald prairies seen at a great height upon the hills, and between it and the Simkwe the forest disappears altogether. The fact was noticed by Lieut. Wilkes, in his memoir on Western America, that south of 48th parallel the line of forest terminates at about the same distance from the coast, and this appears substantially the case; nor is the fact much altered by the difference of elevation. Emerging from the forest, the ground was literally covered with fragments of basalt, varying in size from large blocks to pieces resembling macadamized pavement—some compact, some cellular or scoriaceous. Interspersed were beds of tenacious blue clay, which had retained the footprints of horses since the spring. The source of such a deposite in this situation could not readily be traced.

The two streams last mentioned unite and form one fork of the Yakima, to the lower part of which the Indians give the name of Pisko. The aspect of the country, on descending to its valley, is one of extreme desolation. Narrow ravines or cañons, bordered by walls of basalt, having a rude columnar structure, converge from the mountains, the strata dipping towards the east at a small but varying angle. The foot-hills are clothed with purshia and artemisia, and strewn with silicious pebbles. The bottoms are barren and stony, and intersected with arroyos. A narrow and broken line of dwarf oaks and willows indicates the windings of the stream. The Indians have indeed, here and there, on the margin of the water-courses, small garden patches, where they raise potatoes, a little corn, and other vegetables; but the country generally is a desert. The elevation of this valley, at the forks, is 1,519 feet above Vancouver. From that point the course of the expedition was nearly north, crossing the several branches of the Yakima. The general direction of these is from northwest to southeast, very nearly the reverse of that followed by the rivers on the western side of the mountains. The main stream, which heads not far from latitude 47° 30′ north, is, on reaching the valley, deflected by a heavy range which breaks off from the Cascades and curves to the south, separating the waters of the Yakima from the Pisquouse and the Columbia, and terminating near the mouth of the first. It thus forms a basin, in which the upper waters of the Yakima are enclosed. Spurs from this range run towards the Cascades, sinking into the general level of the intermediate plateau, or uniting with corresponding offsets of the latter. The main Yakima cuts through four of these spurs, at the very base of the range, before again turning to the eastward, and its various branches have eroded from the plateau the valleys through which they run to meet it. Long horizontal lines of basalt bordering these valleys indicate the original level of the basin, though it would appear that elevation has at some points disturbed it. Traces of lacustrine terraces are also observable, formed probably before the river had completely broken through its barriers.

The basalt is continuous, along the base of the Cascades, on the line from the Dalles northward to the Columbia at its bend near the mouth of the Pisquouse. To the eastward it stretches across the great Spokane plains. Upon the divides between the Wenass and the main Yakima, and between that and the Columbia, it is interstratified with coarse basaltic conglomerate. Its western limit upon the Cascade mountains is not determined. Upon our route from Chequoss, it was, as has already been mentioned, interrupted by hornblende rock upon the Klikatat river, and in ascending the main Yakima pass; it ceased on ascending the lower hills, where the same rock succeeded it. The rocky bluffs which border the Nahchess, from its source down, consist of basalt and basaltic conglomerate, and the latter crosses the range and is visible upon the sides of La Tête, near the western gate of the mountains. Captain Wilkes mentions that on the summit of this pass the rocks are trachytic, and contain black crystals, probably hornblende. The structure of the basalt varies greatly, occurring both compact, cellular and scoriaceous; and its forms of fracture or separation are as numerous. In the Atahnam valley, which is hemmed in by low mural precipices, two very widely-distinct strata are noticeable; the lower is divided into large columns, from three to five feet in diameter, which, at a little distance, present the appearance of horizontal lamination. On closer inspection, they are found to consist of thin wedge-shaped fragments, a few inches across, and of which they seem to have been built up. One of these columns had been split through the centre, and it was perceivable that the structure extended throughout, the joints being just visible. The columns were cylindrical, and well relieved, both from each other and the wall, and stood ten or twelve feet high above the soil.

The upper stratum was broken into small irregular columns, of the usual character, very compact, and with somewhat conchoidal faces. The same appearance was afterwards noticed in descending the Peluse. In the Sewacksa Pass, crossing the mountains between the mouth of the Yakima and the camp at Wenass, the trail passes through a narrow cañon or crevasse, now the bed of a winter torrent, which seems to have been the immediate seat of some volcanic action. The walls generally are composed of very perfect pentagonal columns, five or six inches through; but at one point, where the face has been broken down, it consisted of cellular lava, containing cavities filled with sublimed sulphur. Seams of sand and ashes occurred here beneath the basalt. In the lower part of the Yakima valley are two or three basins surrounded by walls, partially obliterated, which appear to be the remains of small craters.

The boulders contained in the Pisko, the Atahnam, and other streams lying between the latter and the Nahchess, were of the same description as in those already noticed, being invariably trachytic or basaltic. On reaching the Nahchess, granite and quartzose rock for the first time occur, intermixed with the trachyte. Of this branch, which is the next in size to the main river, one fork heads in Mount Rainier, the other in a peak, having an extinct crater, to the south. As we found that from here northward the trachyte ceases entirely, this river may be assumed, generally speaking, as the northern limit of trachyte, and the southern of the granite series.

On the northern side of the Nahchess, not far from its mouth, the first sedimentary deposit was met with, in a soft, yellowish sandstone, resting on the basalt. Its dip appeared to be to the northwest, and at an angle of 10°. In the lower stratum, at the height of about fifty feet from the level of the valley, a bed of river-sand and stones, precisely similar to those in the present stream, and three or four feet thick, was exposed. Above this was a layer of friable, coarse-grained sandstone, and next a seam apparently of intermixed clay and volcanic ashes about a foot in thickness, which was in turn overlaid by sandstone. The bluffs run to the height of some two hundred and fifty feet, and exhibited several strata, the lower only, however, containing the river-stone and clay. It would appear that a former bed of the Nahchess had been covered to a considerable depth with detritus from the mountains and subsequently elevated to this position, the river meantime seeking a new channel.

The prevalent rocks on the summit of the Cascades, at the main Yakima Pass, were breccias, constituted for the most part of argillaceous or magnesian rocks. These continued as far down as Lake Kitchelus, forming the walls, of the ravines wherever visible. The higher peaks, to the northward, seemed to be of basalt or conglomerate similar to that on the Nahchess, but were too distant to be determined with certainty. Gneiss was observed upon the borders of Lake Kahchess, dipping westward at an angle of 15°. Granite was not seen in place, but is found in boulders in the river. Towards the foot of the mountain hornblende rocks occurred, succeeded by basalt. The most remarkable feature of the Yakima is the series of lakes, through some of which it passes; while the others communicate with it by outlets. The source of the river is itself a small lake, situated on the very summit of the dividing ridge, at an elevation of about 3,600 feet, from which the D'Wamish also, emptying into Puget sound, derives its origin. It thence passes by a very rapid descent to another somewhat larger, and again into a third, falling, in the course of five miles, over 1,000 feet.

Lower down it receives through one outlet Lake Kahchess, into which a smaller adjunct empties, and by another Lake Kleallum. The largest of these is about eight miles in length. The lower lakes, particularly the last, bear evidence of a former much greater extent; lines of terrace of considerable height being apparent at a distance from its present bed, and there is abundant proof on the river that the chain was once more extensive. The existing lakes are deep, excepting the small one at the summit of the pass.

The upper valley of the main Yakima, from its exit from the mountains to the mouth of the Atahnam, is separated by the spurs already alluded to into several basins, of which that around Ketetas is the largest. In these there are some traces of pretty good soil, chiefly on the margin of the streams, but very limited in extent compared with the barren country around. The lower valley, which is much larger—being from six to ten miles wide, and forty in length—is, for the most part, a waste. The soil throughout is sandy, and there appears to be but little difference between that in the bottoms and on the hills. The artemisia, purshia, and composite, as a general thing, cover the ground to the line of the spring freshets. It is the opinion of many, indeed, that wheat would thrive well upon the artemisia lands, and that in particular winter wheat would be sufficiently advanced before the drought sets in not to suffer by it. The fact remains to be ascertained by experiment, but as applied to the district at large does not seem probable. Upon the immediate borders of the river the land produces pretty well. The potatoes raised by the Indians are very fine, in spite of their rude cultivation. Melons and squashes, which they also raise, do not succeed well, probably on account of their seed being poor; but corn does not thrive at all. The grasses are abundant only in particular tracts, and, though this may be called a grazing country, it is not a good one. The depth of snow in winter would make it necessary for the farmer or grazier to lay up supplies, for the Indian stock are driven to the artemisia itself for forage, and become excessively lean as well as unsavory.

The banks of the Columbia, from the mouth of the Snake up to the mountains, are a waste of sand, bare of everything but the artemisia and the plants usually accompanying it.

As a whole, therefore, this section of the country does not promise much as an agricultural region. The long drought during the summer presents serious obstacles to cultivation, independent of the soil. It is a matter deserving of consideration, however, whether the introduction of deciduous trees upon an extensive scale would not materially improve the character of the valleys.

Next to the basalt, which forms the universal rock of this section of the country, its most striking feature is the amount of detritus which fills the valleys, and covers to a considerable extent the secondary or lower hills. This detritus appears to have been the wash of the neighboring mountains, or the decomposition of subjacent rocks, and not to have been transported from a distance. It would seem that the whole of the inner basins of the Yakima have been eroded by its various branches, and its materials gradually swept down to the Columbia. The higher ranges of hills present long and somewhat uneven summits, deeply furrowed by ravines. The lower exhibit the characteristic features of basaltic tables, but slightly indented. It is remarkable that, in so great an extent of mountain country, and where drift forms so large an element, there should be no appearance whatever of glacial action. The surface of basalt is unfavorable to the preservation of diluvial scratches, it is true; and the effects of ordinary frosts in separating its joints cannot readily be distinguished from the crushing caused by large masses of ice. But there are no moraines sufficiently well defined to be recognised, and no transported boulders of any magnitude. The whole seems to be the result of a more gradual action and of nearer origin. In the upper part of the Wenass valley, there is, indeed, a range of low hills in the midst, which at first sight were supposed to be moraines, but it was afterwards concluded were more properly referable to erosion.

Low terraces of deposited land and gravel occasionally line these valleys, and upon the lower Yakima are traceable continuously for some twenty miles, the height above the present bed of the stream increasing gradually with its descent. These are, however, by no means so remarkable as the terraces upon the upper Columbia, which will presently be noticed. The rivers all wander extensively over beds of sand and stones, with very low banks. The associated minerals of this region are but few, and those not of great interest, with the exception ot gold, which occurs in all the branches of the Yakima. It is in very fine particles and much worn, and seems to be greatly diffused. The *color* could in fact be obtained almost everywhere in the surface sand upon the streams. An attempt was made to find it by digging deeper, but without success. In fact, the absence of bed rock or strata of clay in the streams, at accessible depths, renders the chance of successful mining upon them improbable. If gold is found in sufficient quantity to pay for working, it will probably be in dry diggings or in the rock. The

Indians were in possession of one or two pieces of some size, which they said they had found in the mountains, where there was more of it; but their statements are not to be relied on, and it was considered probable that they had brought them up from the settlements. They never could produce others, or point out the locality of what they had. That gold will be found in quantity, at least in this part of the range, is, however, questionable, as the talcose rocks, if not wanting, are very limited in extent. To the northward they are somewhat more abundant.

The range already spoken of, which separates the Yakima from the Pisquouse and the Columbia on the north and east, is little if at all inferior to the average height of the Cascades themselves, the point at which the trail crossed them being 5,749 feet by barometrical measurement—an elevation much greater than either pass of the Cascade mountains. It appears to be formed entirely of basalt and volcanic conglomerate, the latter showing only on the northern side of the Columbia. On the southern slope the basalt was but superficially covered with earth, and the strata seemed to dip towards the southeast. The tops of the columns were much broken up, the fragments strewing the hills, and, where denuded by the winter rains, exhibiting long black striæ on the surface. On the tops of these mountains, however, there are quite extensive levels of prairie and open woods, and the soil seems to be better than on the lower ridges. The timber, at first yellow pine, changes towards the summit to a straggling mountain species, intermixed with larch, spruce, and fir. Some of the larches were here as much as three feet in diameter.

The view from these mountains was magnificent. On reaching an open spot in our descent, we saw the Columbia just beneath us flowing through a vast cañon at its great bend; to the east stretched the central basaltic plateau, rising towards the north into high and broken tables, beyond which appeared the gap of the Okinakane; while to the west and northwest the craggy sierra of the Cascades reared itself above the lines of forest into the limits of perpetual snow. The character of this range changes materially with its geological formation; naked and precipitous ridges, surmounted with sharp peaks, rising singly or in groups, some of which seem to be the skeletons of mountains, distinguishing the granitic from the tamer features of the basaltic region. The country on the Columbia from this point exhibits a corresponding change. On the left bank, basalt continues to the Spokane river, being underlaid, according to Lieutenant Wilkes, by granite; and on the right bank it occurs interstratified with conglomerate at the foot of the mountain, but ceases entirely a few miles above. How far down the river it continues we had no opportunity of noticing, but presumed that it ceased at the Priest's rapids, as it is abrupt for some distance above the mouth of the Yakima, where the banks, though high, consist of sand and boulders only.

A little below the mouth of the Pisquouse the rock on the west bank changes to gneiss, which near the river is broken up and scattered in enormous masses. Veins of quartz, covering each other at different angles, intersect it, varying in thickness from a narrow line to several feet. It is the prevailing rock on this bank as far as the mouth of the Enteatkwu, in one place resting upon a gray porphyry. The strata were somewhat displaced, and occasionally had a slight dip to the northward. The Pisquouse is a large and bold stream rising in the main divide of the Cascades, and interlocking with one of those running into the Sound. It passes through a lake, reported by the Indians to be larger than either of those on the Yakima. There appeared to be no valley as far as could be seen, and but a small bottom at the mouth. Quartz boulders were conspicuous in the stream. We noticed pipes brought by the Indians from higher up the river, some of which were talcose slate, and others of stratite. Gold was found here also, but in finer particles than that in the Columbia. Approaching the Enteatkwu, syenite replaces the gneiss. Its precipitous bluffs were occasionally intersected with large dykes of reddish quartz, breaking into angular fragments. The lacustrine terraces, which line the bluffs of the Columbia and its tributaries from the Pisquouse northward, form one of the most remarkable features in the geology of the country. A glance at the map of the region drained by the upper Columbia and by Fraser's river exhibits a considerable number of lakes, mostly of elongated form, such as they would necessarily assume in the narrow valleys between parallel chains of mountains. But these existing lakes are the few and scattered remains of a vast system which stretched its arms into every recess long after the general elevation of the continent, and which has, in the course of time, been drained by the successive bursting of the barriers which confined them. Sufficient observations have not been made to determine their exact relations to each other, and to the expanse of water which seems to have occupied the country on the Columbia and Snake rivers, from the Dalles upward; but the records, it is believed, exist for establishing with an extraordinary degree of accuracy the limits of each. The barometrical observations of the expedition were made with a view to the more direct objects of the survey only, and do not present any connected series of results bearing upon the former hydrographical face of the country. Such facts as have been collected will, however, serve at least to point the way for future observations. In conducting any regular geographical survey of the country, and especially in running and marking the boundary, lines of elevation having reference to the comparative heights of these terraces would have peculiar interest.

Besides the terraces which line the valleys, another class, not characterized by the same straight lines, but arranged in amphitheatres, or otherwise conforming to the make of tbe elevations against which they rest, appear on the summits of the ranges dividing different branches of the Columbia. In crossing from Fort Okinakane to the Methow river, and again from the Okinakane lake to Fort Colville, such terraces were noticed at heights too great to suppose them to have been deposited, except at a period when the elevation of these mountains was in its early stage. As regards the others, however, they bear every mark of a much later date.

As the route of the expedition met the Columbia above the lower obstructions through which it has forced its way, the point of the first barrier cannot be given with certainty. It is supposed to have been about the Priest's rapids, and another very probably intervened between that and the Pisquouse. Upon this supposition, the Grand Coulée, which is said *not* to have been a continuous channel, may have been an arm or strait cutting off an island or peninsula. Numerous other coulées, which once separated islands, abound among these mountains, the terraced banks remaining at each end towards the river, while the intermediate level now constitutes an elevated valley or "land strait." Such was the pass by which the expedition passed from the Columbia to Lake Chelan. The destruction of the barriers upon the rivers seems, in some cases, to have been violent, and others gradual. In the former case it would probably result that a mass of earth and rock, in proportion to the body of water liberated, would be swept down from the shore in the neighborhood of the ruptured dam. This may have been the cause of the removal of the large masses of gneiss which have been torn from their bed below the Pisquouse, as already mentioned, and scattered along the shore of the Columbia. These evidently originated in the immediate neighborhood, as they are not worn by transportation, and the strata above them seem to have been disrupted. Under any circumstances where a rapid current prevailed, but more particularly where its egress was sudden and violent, if the valley were circuitous, the terraces, consisting of sand and loose stone, would be swept away, in a great measure, unless protected by the bends of the river, in which case they would appear alternately on the different sides of the stream. Where, on the other hand, the fall was slower, as from the subsidence of the water by gradual or steady drainage, the terraces would remain perfect on both sides. So, too, if the subsidence were altogether checked, from time to time, for a considerable period, or occurred merely at irregular intervals, successive steps would be formed of greater or less height according to the amount of water escaped, and of greater or less width according to the length of the intervale, the diminution of the entire body of water, or increase in the amount of detritus brought down. The lower terraces in a valley will naturally be widest, because an amount of material, brought down during higher stages of water, will have been directly precipitated or spread out, forming a level floor at the bottom of the valley, and its erosion will take place only to an extent proportioned to the size of the usual stream.

The upper Columbia and its tributaries, through the whole route of the expedition, presented this formation upon a scale of singular magnitude and variety of circumstance. It is probable that in this northern district, where the winters are exceedingly cold, ice has played an important part upon these elevated lakes; but the surface of the country exhibits no evidence of its action subsequent to their drainage, and there are no appearances either of the former existence of fixed glaciers, or the transportation of boulders from a distance by moving bodies. In fact, rocks out of place are of very rare occurrence, considering the mountainous character of the country, and nowhere to a size or extent beyond the capacity of ordinary causes.

On leaving the Columbia to visit the Chelan lake, our route ascended one of these terraces, rising to the height of six hundred and forty feet in a single slope, and occupying a recess in the hills which bordered it. On reaching the top, it proved to be the entrance of a level valley, extending through the hills and emerging at about one hundred and fifty feet above the lake. This valley or coulée is only one of a number noticed in this region, and is analogous to the "cots" or "land straits" described by Sir Charles Lyell, (Manuel El. Geol., ch. vii.) The lake is four hundred and seventy-four feet above the Columbia at its mouth, and its outlet makes this descent in about four miles. It did not appear to be very deep, though it occupies a narrow valley between precipitous mountains of syenite; the detritus of these having probably filled it up. Its length seems, from Indian account, to be thirty-five or forty miles. It affords a good illustration of what the other terraced valleys formerly were; the appearance of its shores indicating that, should the barrier at its mouth be removed, similar terraces would remain to those which border the Columbia at its mouth.

The most remarkable exhibition of these is, however, upon the Methow river—the barrier R. of Wilkes's map. In crossing the mountains between Fort Okinakane and that stream, we noticed, upon the summit and high up on the sides, remains of those formed previous to their elevation; but the valley of the river itself is lined with others of a later date. According to two or three of the barometrical observations taken in surveying the supposed pass, the altitudes of these appear to agree sufficiently with some on the Columbia to indicate their connexion. In descending the river, we met with two dams or barriers which had once restrained its waters, and concerning which there could be no question. The first was externally a mere well of detritus, though probably with a rocky foundation. It was level on the top, and sloped at the sides like the lateral terraces. Half a mile below was the second, which was formed against a protruding point of rocks. In both cases the river had cut merely a narrow channel through them on one side, leaving the rest standing. The walls of syenite on the Methow were in many places cut and smoothed by the action of the water at a height of seventy-five or eighty feet above its present bed. At the mouth of the river no less than eighteen terraces, rising one above another, were counted. Small moraines were noticed in this valley, but apparently rather the result of violent rush of water from lateral branches than of ice. The valley of the Methow affords a richer field for the geologist in plutonic and metamorphic rocks than any other portion of the Territory visited by the survey, and would richly reward a careful exploration. Gneiss, syenite, and granite occur, well characterized and blended with each other. The syenite is often divided by joints so as almost to appear stratified, and to give its perpendicular walls the semblance of artificial construction. The gneiss is found both horizontal and displaced by the intrusion of trap. Associated with these are also serpentine conglomerates and prophyry. Almost all these rocks pass by insensible gradations into one another, and their relative positions are excessively complicated. There appears to be a very great resemblance between the geology of this part of the Cascades and that of the Shasta mountains, as described by Wilkes in his memoir on Western America.

The rock in place on the Columbia between the Chelan and the mouth of the Okinakane was syenite, varying somewhat in character. It was frequently intersected with large veins of feldspar. In crossing from Fort Okinakane to the forks of the Methow the syenite changed to granite, with white and flesh-colored feldspar. The bend of the Columbia at Fort Okinakane seems to be the northern limit of basalt to the east side of the river, as the Pisquouse is on the west. The prevailing rocks on the Okinakane as far up as its forks were syenite and gneiss; above that point, granite and gneiss, overlaid with coarse conglomerate containing granitic masses. The gneiss is much altered by contact with this, its stratification being obscure and often contorted. At the foot of the principal lake, porphyritic rocks replaced the gneiss. On the west branch of the Okinakane (the Mil-a-kite-kwu) the conglomerate formed the predominant rock. There was first noticed talcose slate in place, but much dislocated. Gold was found in both branches, in rather larger and sharper particles than below. The soil of the valley is sandy and in some places covered with alkaline efflorescence. We met with two or three small lakes, the waters of which were impregnated with the salt incrustations which had formed on their borders.

The valley of the Okinakane presents a series of basins divided from one another by projecting points, which exhibit marks of disruption. The sides are terraced as on the other streams, some of the tables rising to the height of 1,600 feet above Vancouver, or about 900 above the river. The lower of the existing lakes were once all evidently connected with the Upper or Great lake, and have been separated by the alluvial deposits filling up the intermediate tracts, which now form reedy marshes. They all appeared to be shallow, except in channels in the centre. In returning to the forks, on the eastern side of the river, we passed through one of the coulées, terminated at either end by terraces, in which were several small lakes at the foot of the precipitous bluffs, in situations which suggested that their beds had been scooped out by eddies in the ancient stream.

The width of the Cascade chain at the latitude of the forks of the Okinakane is probably seventy-five miles, and a large basin would seem to be enclosed between the ranges respectively bordering that river and Puget sound. The western range is broken and craggy, rising in points to the snow-line. Mount Baker was not visible from even the highest points that we passed over.

Ascending the divide between the Okinakane and the waters of the small river emptying into the Columbia at Fort Colville, the terraces were found surrounding an upper basin at the summit. The height of this by an aneroid barometer was 2,647 feet over Fort Vancouver, and 1,500 feet above the lake. This divide was rolling, covered with bunch-grass and wooded with pine and larch, with a few cedars and firs intermixed. Birch and poplars were noticed in the valley. The paper birch does not appear to grow south of the 48th parallel.

Here again the conglomerate overlaid syenite and gneiss; and following the stream, serpentine, granite, greenstone, gneiss, porphyritic serpentine, quartz rock, crystallized carbonate of lime in large veins, and talcose slate, were found. Approaching the Columbia, gneiss and stratified quartz prevail. This last forms the cañon at the mouth of the stream, and a vein traversing the bed of the Columbia a little below it causes the cascade known as the Kettle falls. The soil in this valley is a light sandy loam, much better than that on the Okinakane.

From Fort Colville the trail towards the Spokane river rose by another high terrace to a valley, through which a small stream flows into the Columbia at the falls. This valley is flat and marshy, and evidently has formed another lake or arm. The soil is clayey, and generally of good quality, with a subsoil of gravel and round stone. A small colony of Hudson's Bay Company's servants whose terms have expired have here commenced farming. They state that the small grains and roots thrive well. The company formerly raised in this neighborhood sufficient wheat to supply all their northern posts with flour; but the climate is cold, and the winters set in early. On the 23d October the thermometer stood, at the camp of the expedition, 10° at sunrise, and on the 24th snow fell to the depth of six or eight inches.

Quartzose rock, gneiss, granite, and talcose slate occur in the hills bordering the valley. A low divide separates it from the Chemakane, which runs into the Spokane. Approaching the latter river, basaltic dykes show themselves occasionally, the debris of which forms small pyramids.

The hills between the Chemakane and the forks of the Spokane are of syenite, decomposing freely on exposure to the air. South of the Spokane, basalt resumed its place as the prevailing rock, forming the high table-land known as the Great Plain of the Spokanes and Nez Perces, and extending to the Columbia on the west and across the Snake river to the south. Near the Spokane, however, the syenite occasionally protrudes through it, and even as far down as the camp of October 30th and 31st, appears on the borders of a small lake lying to the east of the trail. The soil of these plains is generally thin and sterile, and covered with oxyde of iron from the decomposed basalt; but in the swales, along the margin of the small streams, it is a rich, black mould. Bunch-grass grows plentifully upon them, and they afford a good range for the horses of the Indian tribes to which they belong. It is, however, to be considered that, in all the stock-ranges of this country, the scattered growth of the wild grasses renders necessary a large comparative extent of country. These plains, except on the northern skirts, are destitute of timber, and are swept by high and piercing winds. Their surface is generally undulating, with occasional hills rising to the height of 100 or 200 feet, some of which seem to indicate, in their tabular summits, the former existence of a general covering of detritus since swept away. Lines of low terraces are also observable in places. Quite a number of small lakes are scattered over this field, many of which appear to have been craters. On the line pursued by the expedition, a series of these continued for half a day's journey, apparently connected by a crevasse. They were of circular shape, and surrounded by walls of basalt. The water contained in them was generally saline and nauseous.

Approaching the Snake river the plain becomes more broken, though the general level is pursued, and the beds of the streams deepen as they descend. The basalt exhibits the usual different forms, and in structure ranges through every variety, from scoriaceous to compact. In the cañons of the Peluse the strata were often curved, the individual columns retaining their perpendicularity to the base, radiated from or towards it according to circumstance. The lowest stratum in several places exhibited the same separation into columns, separated by horizontal cleavage into plates resembling stratification, as those previously mentioned in the Atahnam valley. The next above it was sometimes in massive blocks, constituting a sort of compound column, while the superior ones were slender, of pentagonal or hexagonal forms, and convex at the top. Many of the larger blocks separate with conchoidal faces. We noticed on these plains numerous small mounds left by the water, which had washed away the surrounding soil, in the same manner as those on the mound prairies near Olympia. The descent of the Peluse into the Snake river is one of the most remarkable scenes in the whole of this region. The waters have hollowed out a large basin, in the midst of which stand pinnacles and needles of every form and size; while black and broken precipices rise in fantastic irregularity around it to the height of three or four hundred feet.

The country south of the lake, from opposite the mouth of the Peluse to the head of the Wallah-Wallah, consists of high rolling hills, rising to about the same level with the Spokane plateau, but composed of sand resting on the basalt, which shows only in the ravines. They are cut with ridges and spurs by the action of water, are destitute of wood, but produce bunch-grass in greater abundance than the northern plains. Much of the land in the bottoms upon the Wallah-Wallah and its branches is covered with alkaline efflorescences, but there are tracts of very rich soil. Indian corn can, it is said, be considered a sure crop; melons, tomatoes, and the finer vegetables grow well, and it is believed that wheat would thrive on the hills; but the country is better adapted to grazing and gardening than farming. The same remarks will, it is believed, apply to the heads of the Umatilla and other streams rising in the Blue mountains. The lower part of the Wallah-Wallah valley is a waste of sand and sage. Large boulders of granite are found in the banks of this stream, but from whence transported, sufficient is not yet known of the nearest cascades to determine.

The cañon of the Snake river extends down to its mouth. The country on the Columbia from thence to Wallah-Wallah is a level plain of barren sand. Below the fort, high basaltic bluffs again rise on either side, affording some of the most picturesque scenery upon the river. They continue for some twenty miles, below which they are interrupted, the plains coming down to the river for a considerable distance. Towards John Day's river (the Mah-hagh) the bluffs recommence, rising two or three steps and surmounted with hills. Thence approaching the Dalles, the country becomes more and more broken. It is noticeable that in the basalt upon the Columbia, particularly in the neighborhood of the Des Chutes river, (Wan-waw-wi) the basaltic columns often converge at the top without the horizontality of the beds being interrupted. At Willow creek, (the Hockspe,) the artemisia disappears, that river forming its western boundary to the south of the Columbia. Below the Des Chutes the hills are freckled over with mounds, not only on the summits, but the sides also; and it would seem that the forest once extended to this limit, and has probably been driven back by fire. These mounds differ entirely in character from those mentioned as occurring on the plains, and from those crossing the gravelly prairies near the head of Puget sound, the origin of which is clearly due to water.

At the Dalles the basalt is overlaid with coarse conglomerate, chiefly formed of masses of porphyritic rock imbedded in sandstone. This occasionally stands up in needles, which have been protected from the weather by boulder caps. The hill-sides would seem to indicate that the barrier at the entrance of the river into the mountains was suddenly broken, and the superficial earth and strata swept away. Traces of terraces remain on the north side of this entrance at a considerable elevation. The basalt, associated occasionally with conglomerate, lines the river to within twenty-five or thirty miles of Fort Vancouver. The origin of the cascades has already been referred to. There seems to be no question that a slide from the mountains on the south side has actually taken place, and that the water has thus been backed up above it. No evidence exists of any subsidence of the low alluvial shores, by which what is called the sunken forest has been submerged, but that its position is simply due to this rise of water.

I have the honor to be, sir, your obedient servant,

GEORGE GIBBS.

Capt. George B. McClellan,
Commanding Western Division N. P. Railroad Exploration, &c.

FINAL REPORT OF LIEUTENANT C. GROVER, OF HIS EXAMINATIONS FROM PIKE LAKE TO FORT UNION.

Sir: Pursuant to your instructions, on the 25th of June I left the Red river trail at Pike lake, in order to pursue a more southern course to Fort Union, on the Missouri, than that marked out for the main party of the expedition under your command.

The principal topographical features of this immediate locality are those of a broad rolling prairie, falling off gently to the south, and partially drained by small streams tributary to the south fork of the Chippeway river. Many small lakes, a general peculiarity of the prairie country previously passed over, are also found here; they are mostly the result of imperfect drainage, being fed by falls of rain, and are much less numerous in the dry season. Those that appear to be permanent have sandy bottoms, and are generally thinly skirted with scrub-oak, the principal growth of this section of the prairie. The formation is a loose drift, having more or less gravel in its composition, according to its elevation. Granite boulders, of from a ton's weight down, are sometimes seen, but they are not numerous.

The south fork of the Chippeway river, which I crossed nine miles from Pike lake, winds through rather a depression in the prairie than a valley, as the difference of level between its bed and the adjacent country is but small. It has a general width of about thirty yards, and a depth of about six feet. Its bed, as well as the bed of its small tributaries, is sandy. The velocity of its current is about four miles an hour. Its banks are not wooded.

About nine miles from the Chippeway the Pomme de Terre river was crossed. This is a stream of about the same width and depth as the latter, though not quite so swift.

West of the Pomme de Terre there are no streams of any consequence to the foot of Lake Traverse. The prairie gradually changes its character, and becomes by degrees less rolling, to the "Moose Island" lakes—a series of small lakes fourteen miles from the Pomme de Terre river, and very similar in character to those already mentioned. Thence westward, to the foot of Lake Traverse, the country becomes almost a dead level—quite soft, and in places marshy, without a tree or a twig to break its monotony. How far to the north it preserves this character I do not know; but to the south, after a few miles, it gradually rises, becomes rolling, and throws its surface-water into small lakes, which are sometimes the sources of small prairie streams flowing in a southwestern direction.

Lake Traverse is a beautiful sheet of water, about twenty miles long, with an average width not exceeding three miles. It is studded with now and then a small island; but wood is by no means plenty— probably through the instrumentality of the Indians, and frequent prairie fires. Its surface is sixty or seventy feet below the general level of its banks. These latter are quite abrupt, and serrated with deep ravines, branching off in every direction from the lake, and drawing off the surface-water from the vicinity.

About three miles from its foot it receives, from a northeastern direction, a tributary called the Rabbit river—a small stream, not exceeding ten yards in width, with a rapid current and rocky bottom. This stream is walled in by high and rather abrupt banks towards the water-course, but sloping off, to the east, to the general level of the prairie, and to the west to the bed of the Bois de Sioux river. Deep cutting would be found necessary here, with perhaps a fair grade in addition; but the earth is of a loose, gravelly nature, intermixed with boulders of various sizes, and would not, therefore, be difficult to work.

The Bois de Sioux river rises in Lake Traverse, and running in a general course a few degrees east of north, is tributary to a branch of the Red river. Its current is almost imperceptible—not exceeding one mile an hour; its bottom is sandy, and its width varies from forty yards to a hundred or more. Its depth is generally not more than four feet. In ordinary stages of water its surface is nearly flush with the broad intervals which stretch along on either side between its course and the higher adjacent prairies; but in a wet season, or when the winter snows begin to melt, it overflows its banks and expands to a mile or more in breadth.

Between the Bois de Sioux and the Wild Rice river, which is also tributary to the Red river, there is scarcely a perceptible divide. The prairie is mostly soft and wet, with no topographical features of any importance, excepting a tract of sand-hills, called "Lightning's Nest," which spring up abruptly from the plains and cover several miles of area. I crossed the latter river forty-five miles, in nearly a due west course, from the crossing of the former. It is about fifteen yards wide and four feet deep, and has a muddy bottom and low banks.

Then, in a course a few degrees south of west, a gently rolling prairie extends to Jacques or James river, about ten miles below the mouth of Grizzly Bear creek. A few miles to the north, however, (the course traversed by my wagons,) several high sandy divides and rocky backbones rise considerably above the surrounding country.

The waters of the James river flow into the Missouri. It is a clear, sluggish stream, with an average width of forty-five yards, depth of five feet, and a hard, clayey bottom. It threads a sinuous course through a rich valley, of from one to three miles wide—which, judging from fragments of drift-wood, is overflowed at times to a considerable extent. At points, however, the overflow is confined within narrow limits.

That portion of the great prairie lying between the James river and the Missouri may be regarded as divided into two terraces. The first has its general level about ninety feet above the bed of the James river, its eastern boundary. Its roll is very gentle—so much so, that the second terrace, or "coteau of the Missouri," may be frequently seen at a distance of thirty or forty miles. There are a few small streams, having their sources in springs a few miles inland, which flow into the river—and other deep ravines, which appear to be the beds of streams during the wet season; but by far the greatest portion of the surface-water is collected in small lagoons, many of which are never dry. The soil is harder and dryer than in the prairies previously passed over, and has more gravel in its composition. The valley of the James river affords a very little wood, fit only for fuel; but between this and the Mouse river, a distance of one hundred and eighty-six miles, not a particle, of any kind, is to be found.

Forty-five miles from the James river my course struck the second terrace, or "coteau." This is a broad expanse of broken country, more or less elevated above the first terrace—irregular in its boundary, and irregular in its topography. Sections of it are merely high-rolling, with sometimes an extended plateau of comparatively even prairie; while other portions are much broken, sometimes rising in abrupt peaks of no great height, and again in long, bare ridges. Small lakes are still very numerous, with the peculiarity that the waters of many are more or less salt; and, where they may have become partially dried up, white incrustations of salt are found about their margins.

Where I struck the coteau the prairie rose from eighty to a hundred feet in two or three miles, and for ten miles was high-rolling and abrupt; but at the end of that distance, with a slight and gradual descent, my course struck a gently-rolling plane, that extends, though not in a direct line, to that boundary of the coteau that runs nearly parallel to, but at some distance from, the valley of the Mouse river. Though obstructions here are not serious, it is quite probable that more advantageous lines could be found, to cross this portion of the coteau.

After striking the valley of the Mouse river, my course to Fort Union coincided so nearly with that of the main party of the expedition, that it is unnecessary for me to write of it.

C. GROVER,
Lieutenant United States Army.

Governor I. I. STEVENS.

FINAL REPORT OF LIEUTENANT C. GROVER, OF HIS SURVEY OF THE MISSOURI FROM THE GREAT FALLS TO THE MOUTH OF MILK RIVER.

SIR: I have the honor to submit the following journal and report of a survey of a portion of the Missouri river.

On the morning of the 22d of September, with a crew of three men to manage my craft, I cast off from Fort Benton in a small flat-boat and floated down the river. Turning a bend in the river, we soon lost sight of Fort Benton and found ourselves shut in from all outward objects, between the high banks of the river; for the Missouri, from its falls for many miles on its way, traces its course at the bottom of a deep cañon worn by its waters.

The faces of this cañon are generally very abrupt and bare, and approach quite close upon the water-course; at the same time determining only the general direction of the river, so that each detour of the stream leaves a small rich interval in the bend, covered with luxuriant grass, and sometimes skirted with a few small cotton-wood trees.

About 11 o'clock we passed the site of an old fur-trading post, formerly occupied by Mr. Harvey, who has now established one about three-quarters of a mile above Fort Benton. At 12 o'clock we stopped to lunch where the river flows under a high bank, composed, for nearly a hundred feet above the surface of the water, of blue marly earth. Some of the lower portions of its surface were covered with a snow-white incrustation of glauber salts, which appeared to have been formed by evaporation of water percolating through the face of the bank.

Continuing on, we soon passed the site of the old trading-post, Fort McKey, marked by the remains of an old adobe wall. This fort was burned some years ago by the Fur Company on account of some difficulty with the Indians, which rendered it advisable for the company to withdraw their post to some point lower down the river. We passed also three small islands and a large one known by the name of "Cache island," just below which, and nearly opposite the mouth of the Maria river, we moored our boat for the night.

The banks of the river to-day have varied from one hundred to one hundred and sixty feet in height; its bed has been very crooked and composed entirely of loose gravel—the stream perfectly clear and transparent. The current flows with a tolerably uniform velocity of about 2.7 miles per hour, except at some points where its unusual shallowness gives a slight increase of rate. The river is considered at this season of the year to be at its lowest stage of water; the depth of water, therefore, found upon any rapid, may be considered as the minimum depth for that point. A number of rapids and shallows have been passed during the day, of which the only ones worthy of notice are, a shallow about five miles below Fort Benton, with only fifteen inches of water on the bar; one opposite the site of old Fort McKey, with twenty inches; and one about five miles above the mouth of the Marias, with twenty-two inches. The increase of current at either of these points is not material.

Beaver are very numerous along the river, and they appear to be very hard at work laying in their winter supply of provisions. At every willowy point they have made great havoc among the willows and small cotton-wood. They select their winter quarters with a sharp eye to the proximity to forage, and if possible establish their domicil near a growth of small cotton-wood. In the fall they fell what, in their judgment, is sufficient to last through the winter, cut it into convenient lengths, and sink it before the entrance of their holes. If they are obliged to go any distance from the bank for their supply, after it is cut they pack it to the water on their backs. They commence their labors immediately after dark, and continue them till daybreak.

Soon after supper one of our men went out with his rifle and shot three, but secured only one, which he shot through the head. The other two were only wounded, and they quietly betook themselves to the bottom of the stream. They invariably sink unless instantaneously killed.

The day's travel has been 20.8 miles, following the river.

September 23.—Last night was quite cool, cloudy, and windy. This morning was clear, cool, and bracing. My men bivouaced in a small clump of willows on shore, but I preferred sleeping in the boat, which had been made very comfortable by springing bows over it and covering it with canvass to protect us from the rain. The beaver killed last night was dressed, and the most of it, including the tail, was cut up and boiled for breakfast. Cooked in this way it is very tender and well flavored, particularly the tail, which is a luxury that would compare favorably with anything upon the table of an epicure. It tasted to me as much like calf's-foot jelly as anything I can liken it to, though it is very hearty and has a peculiar flavor. One tail is enough for a dinner for three men. The skin was stretched by making perforations around the edge and lacing it with strings upon a hoop somewhat larger in circumference than the skin. Its original proprietor must have been very industrious, as I observed he had worn the fur nearly off both his shoulders in carrying wood.

Soon after commencing our day's journey we passed the mouth of the Marias, a very sizeable stream emptying into the Missouri from the north. Like the Missouri, it winds its way at the bottom of a wide and deep cañon; but the faces of the cañon are generally more abrupt than those on the latter river—so much so, that it is a matter of difficulty sometimes, to one unacquainted with the country, to find a place where a pack-mule can be driven up or down the banks. The enclosed valley is from half a mile to a mile wide. Its soil is rich and moist, and supports a luxuriant growth of grass and cotton-wood in abundance, with some alder and wild-cherry trees. The river at its mouth is about one hundred yards wide, its water clear, and its bottom rocky. The first trading-post established in the Blackfoot country was situated near its junction with the Missouri.

We passed during the day some small unwooded islands. The general character of the banks has been the same as yesterday, except at some points they have fallen back with a gradual slope to the general prairie-level, giving us an occasional view of the conical caps of the Bear's Paw and Highwood mountains.

Antelope are numerous upon the banks, but they are wild and seem to appreciate the necessity of keeping out of gun-shot. A few ducks also have been started, upon turning the river bends.

It has been very windy and somewhat cloudy all day, and to-night the air is cool and feels like rain. The remarks of yesterday regarding the regimen of the river will apply equally well to-day, except that there is to-day, universally, a little more water on the rapids. The shallowest ones are as follows, viz: One opposite the head of Spanish island, depth of water two feet; one about a mile higher up, depth same; one about three miles above camp, depth same; and one three miles above that, depth two feet two inches. At all these points the channel is good.

About 3 o'clock we camped on the south side of the river. Its width at this point is 247 yards; and thus far it has varied between 175 and 260 yards. As we have been unable to kill any game to-day, we picked the remaining bones of the beaver for supper. Distance travelled by water 18 miles.

September 24.—The wind continued high and irregular all last night, but at sunrise it abated; and though at times the sky was partially overcast, the morning, on the whole, was bright and genial. Such a morning was well in keeping with the beautiful scenery with which we were soon surrounded. Upon leaving camp we floated gently down the stream in long sweeping curves, and passed several beautiful islands partially covered with a scattering cotton-wood growth, with now and then an old inhabitant, whose barkless trunk and broken limbs marked the effects of spring freshets.

About 10 o'clock we commenced to wind among the bluffs of the Bear's Paw, and the scenery assumed an entirely new phase: the bluffs were now more abrupt and crowded the river; colonnades and odd-detached pillars of partially cemented sand, capped with huge globes of light-brownish sandstone, tower up from their steep sides to the height of a hundred feet or more above the water. Then the action of the weather upon the bluffs in the back-ground has worn them into a thousand grotesque forms; while lower down their faces, seams of volcanic rock from three to six feet thick, with a dip nearly vertical and no uniform strike, beaten and cracked by the weather, rising from six to eight feet above the surface, run up and down the steep faces and projecting shoulders of the cliffs—a most perfect imitation of dry-stone walls. Taking all this into view, it requires but a little distance and imagination to establish a pretty clear case of "old ruins."

About noon we stopped to lunch at the base of what is called "Citadel Rock," a vertical shaft of volcanic rock rising about two hundred feet above the water's edge, and standing upon a base of about forty feet square. There are many cavities in its faces large enough to hold a good-sized apple, which are sometimes lined with crystals of carbonate of lime. I split off the top of a pretty large and nearly transparent one, which I took away as a specimen.

About 4 o'clock we camped on a narrow bottom on the north side of the river. While the men sat about building a fire, I followed a path down the stream a short distance to take a look round the next bend, but had not walked over two hundred yards when, chancing to look towards the bluffs, I saw a fine big-horn buck, walking with a very dignified mien down a narrow path that led to the river, evidently in quest of water. By quickly retracing my steps I escaped his observation, and sent out one of the men, who was an excellent hunter, in pursuit of him. With two shots he succeeded in bringing him down, and we soon had his spare-rib roasting on a stick before the fire. The flesh of the big-horn is very sweet and juicy, and somewhat like antelope in its flavor.

Soon after camping a heavy wind arose, accompanied with clouds and rain, and such evident appearances of a stormy night, that we pitched a tent which we had taken along for such occasions.

We have passed six islands to-day; the two largest of them are known as "Elk" and "Pretty Horse" islands. The latter was so called from its having been used by the Fur Company some years ago as a range for their horses. Among a number of rapids passed to-day, the following are the most important, viz: One opposite Pretty Horse island, depth two feet; one about five miles below that, depth one foot eleven inches; one known as "Kip's rapids," nearly two miles above "Citadel Rock," depth two feet one inch; and one about three-quarters of a mile above camp, depth one foot eleven inches. At all these points the channel was very good. Distance travelled to-day by water 21.3 miles.

The 25th was cold, stormy, and windy, and we remained in camp all day. After breakfast I went up to the bluffs to get a nearer view of some of those pillars of sand, with sandstone caps, referred to in yesterday's journal. By climbing up a goat-path, which, by the way, was no easy matter, I succeeded in getting on the top of one of the globes that rested on a short pillar, and in passing from that to some of the others that were near it. All the balls in this clump were nearly of the same size—between six and eight feet in diameter; and, as far as the eye could detect, as perfectly round as if they had been turned. They had evidently at some remote period formed part of a stratum of sandstone that runs through the adjacent bluffs and overlies a thick stratum of partially cemented sand; and having become detached from it by frost or otherwise, had been shaped by the action of the weather.

At the foot of the bluffs, and in the small runs that led down to the river, were traces of a lignite, and in places[*] glauber salt had collected by efflorescence on the surface. During my absence from the camp the men killed two more big-horns. Width of the river at this point, 180½ yards.

September 26.—This morning we selected the choicest portions of the three big-horns killed at the camp, and stowed them away in the boat for future consumption; for the weather now had become so cold that there was little danger of its spoiling for the present, and it was considered *decidedly preferable to bacon.* The remainder we left for the wolves, who had prowled around with great impatience for the last twenty-four hours for their share of the game.

The high and precipitous sand and sandstone banks previously noticed, continued for a few miles farther this morning, when they became entirely changed in character, receding farther from the river and becoming less abrupt, and covered with a little vegetation. Long narrow bottoms skirted the river on one or both sides, sprinkled with cotton-wood and covered with grass.

About 11 o'clock we passed the mouth of Arrow river, a small stream emptying into the Missouri on the south side. There is some timber here, though not much of a width of interval. This is the point where the Fur Company established Fort Cotton after abandoning old Fort McKey. There are scarcely any traces of the old stockade left now.

About five miles lower down the river the bluffs become very high, and receding on both sides, but much more regular and less broken on the south than on the north side of the river. There are some traces of vegetation on the bluffs, but no wood except a scattering growth of small stunted pines, which confine themselves entirely to the higher portions, and looked as if they scratched together a livelihood with a great deal of difficulty up there.

Soon after 4 o'clock we camped in a fine, broad and well-wooded bottom, between the mouths of the Judith and Dog rivers. The Judith is a small clear stream with a rocky bottom, rising in

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[*] A subsequent analyzation by Dr A. A. Hayes, of Boston, of a small quantity collected, gave the following component parts:

In 100 moisture	3.20
Sulphate of lime	5.60
Sulphate of alumina and iron	3.52
Sulphate of soda	43.40
Insoluble sand	44.00
	99.72

the Judith mountains, lying some distance in a southwestern direction from its mouth. The Dog river, a smaller stream, has its mouth about a mile lower down.

Their valleys are quite wide near the Missouri, and run into each other about a mile from it, forming the most extensive bottom yet passed. Last night it rained nearly all night, and in the fore-part of it some snow fell, which, however, melted immediately. This morning it was wet, cold, and uncomfortable, and remained so till about noon, when it stopped raining, but remained cloudy all day.

Teal and mallard duck have been plenty to-day, and easily approached; just before going into camp we killed two of the latter, which we afterwards made into a stew for supper. No one with a good gun need want for provisions along the river, for game is swarming in its waters and on its banks.

The only rapids to-day that deserve mention are, 1st, one known as "Pablieu's," depth of water one foot eleven inches—channel good; 2d, one half a mile above Arrow river, depth two feet, with several rolling boulders, weighing a ton or less, in it. These boulders get frozen to the under surface of the ice in winter, when the water is low higher up the river, and are carried down with it when it breaks up in the spring, and rasped off in shallow places as the ice goes down. They are uncertain visitors, and remain but one season in a place. Distance travelled to-day 20.3 miles.

September 27.—On leaving camp to-day we took leave for a while of many of the wild beauties of nature which lay scattered along the river in an ever-varying panorama, to take a view of the other side of the picture of nature's wild deformities—a masterpiece in its way. The "Mauvaises Terres," or Bad Lands, which this section is very appropriately called, is characterized by a total absence of anything which could by any possibility give pleasure to the eye, or gratification to the mind, by any associations of utility. Not an island, nor a shrub of any account—nothing but huge bare piles of mud, towering up as high as they can stand, and crowding each other for room. The banks, varying from 200 to 300 feet in height, were of this nature on both sides of the river all day.

I was told that the land was of the same character for some miles back, on both sides; I was unable to get a look at it myself. After camping I did try to climb up to the top of one of them, but the surface was saturated with water, and when I got half or two-thirds of the way up I was invariably treated to a slide of fifty or sixty feet down again. After several fruitless attempts I gave it up in disgust. There is a curious crag of rock on the profile of the hill, about two hundred feet above the water, on the other side of the river nearly opposite our camp, which from some positions looks like a human head down to the shoulders. The resemblance is so striking that it is called the "Good Child's Head," and has become a landmark on the river.

An unusual number of rapids have been passed to-day: one about a mile below the mouth of Little Dog river has one foot eleven inches of water on it—channel good. Another a mile below that, two feet three inches of water in the channel, with several rolling stones on each side of it. But the worst place, by far, yet found in the river, is what is called "Dauphan's rapid:" the water here was only one foot eight inches deep; rate of current, which is the greatest yet found anywhere, was nearly five miles an hour, and in addition several rolling stones were found lodged on the bar. All the other rapids had two feet three inches and upwards of water, and good channels. The day has been cold, cloudy, windy, and uncomfortable, a very fair accompaniment to the scenery. Distance made to-day 19.2 miles.

September 28.—To-day has been very agreeable, though at times a little cloudy and windy. But the banks, as far as the "Mauvaise Terre" extends, which is to within two miles of camp, are just as abruptly broken and hopelessly barren as yesterday. There have been, however, narrow strips of passable bottom-land, with now and then a little wood on one or the other side.

About 12 o'clock I met Mr. Harvey's hunter, in advance of his keel-boat, from whom I understood they were about forty days from the Yellowstone. Soon after we met the boat itself, which his party were cordelling up the river, heavily laden with Indian goods. The draughts of these keel-boats vary from twenty-eight inches to three feet; consequently, when ascending the river late in the season, they are at times forced to lighten them over the worst rapids.

Game in the Mauvaise Terre has been corparatively very scarce; antelope and big-horn do occasionally come down from the bluffs to drink, but they evidently don't find sufficient attractions about the locality to induce them to prolong their stay. As to us, we are perfectly willing to leave it, and look forward to something less monotonous.

There are three bad points in the river, passed to-day: first, a shallow, about four miles below our last camp, where the river spreads out much broader than usual; depth of water one foot eleven inches—channel otherwise good. Second, what is called the "Three Channels:" the water here is divided by a gravelly bar; depth two feet two inches; channel crooked. And third, and worst, the rapid opposite "Cow island." There is but one foot nine inches of water in the channel. The water is here divided into three parts: one a stream running round "Cow island;" another making between "Cow island" and a sand-bar; and the other, the main one, passing to the left of all. The width of the river at camp is 228 yards. Distance made to-day, 26.3 miles.

September 29.—We are rapidly approaching a more inhabitable country. The bluffs are less high and more sloping, and covered with grass. The bottoms along the river increase in width and richness of soil, and fields of rank grass alternate with thick groves of cotton-wood, cherry, and willow. The larger points of timber at this season of the year are overrun with bands of elk and deer, which seek the protection of the thickets from the cold autumn storms.

The bed of the stream, which was before rocky, is now at times sandy or muddy, and supports an occasional snag, and the water grows turbid and Missouri-like.

About half-past 4 o'clock, when we began to think about camping, we suddenly came upon a large band of elk, on a sandy beach in a sunny nook of the river, enjoying themselves, each according to his own fancy. Some were lying down; some were practising the art of self-defence with their horns, while others were looking on. Upon seeing us, however, they all disappeared into the timber, except one, the patriarch of the flock, who remained behind to cover the retreat of the others, and satisfy his own native curiosity. But he lost his life by his temerity, and we gained a skin and pair of horns—nothing more, for he was too old and rank to furnish very delectable steaks.

Before sunset I followed a buffalo trail to the top of a high hill near at hand, from which I could see the surrounding country—a woodless rolling prairie, running back in the distance as far as the eye could extend. While standing there, looking at the several herds of buffalo grazing in the distance, I noticed as many as twenty wolves, sneaking, with their tails between their legs, from different quarters towards our camp. They had learnt the news of the dead elk. There are a few scattering pines on the bluffs along here; also some short, scrubby, red cedar, covered with berries, but no other shrub.

About two miles above camp we passed a small stream, making in from the north, which my pilot said was called "Little Rocky Mountain river," and was never dry, as many of the small streams are, late in the summer. Another small stream coming in from the south—without a name—was passed a little below "Two Calf" island. Of the rapids, one opposite "Two Calf" island has two feet of water, with a few large loose rocks near the channel. All the others have upwards of two feet of water, and good channels. Distance travelled to-day 28.2 miles.

September 30.—It was cold this morning, and frosty, and the trees glistened like crystals in the rising sun, as we pulled up stakes and cast off into the stream. We can appreciate a bright sunny day again, as we have not had the like for about a week. The river winds with longer and more regular curves, leaving heavily-wooded points of timber, bounded on three sides by the channel, alternating from side to side. The channel, too, is much improved; there are no rapids to obstruct it, and a greater depth of water. The river bed, which was before mostly gravel, is now becoming mostly clay and sand, and the few islands passed to-day have been pointed off by sand-bars at both ends, Missouri fashion. The bluffs are lower and more receding than yesterday, particularly on the north side.

About 2 o'clock we came unexpectedly upon a band of elk, swimming the river, and succeeded in killing a fine doe, which came very opportunely, as our supply of big-horn was entirely exhausted. About 5 o'clock we camped on the head of a large wooded island, under the banks of which there were a great number of beaver lodges. About sunset two buffalo came down from the main land and swam the river, just below camp. Intent upon getting a hump rib, I started in pursuit, and by creeping along under cover of a deep fringe of willows, approached within ten paces of the hindmost one, and, taking deliberate aim about two feet below the hump, which was the only part to be seen above the willows, fired. The old bull (as it turned out to be) elevated his short tail straight in the air, and, with one grunt, put off at full speed into the woods; and though I trailed him, by the blood, for more than three-quarters of a mile, I lost him at last; probably in some thicket, where he deposited himself for the benefit of the wolves. A sick or wounded animal stands but a little chance of recovery, for the wolves follow and harass him till, through exhaustion, he lies down perfectly helpless, when they proceed to make a meal of him before the life is out of his body. Distance travelled to-day, 30 miles.

October 1.—This morning was clear and frosty again, and every sound was echoed and re-echoed with long vibrations as we floated down the stream.

The river to-day is in all respects very similar to what it was yesterday, but gradually growing a little wider. The banks on both sides are somewhat broken, and in places quite high. The general course of the river changed about 9 o'clock from nearly southeast to nearly due south as far as the mouth of the Muscle Shell, a very considerable stream emptying in from the south, which was passed about noon. I did not measure its width, but judged it to be considerably less than one hundred yards. It is very low now, but earlier in the season it probably throws in a large body of water. Its bed is very similar to that of the Missouri at its junction; and, like it, it is skirted with low grounds well covered with cotton-wood.

A short distance above the mouth of the Muscle Shell we stopped to lunch, and afterwards picked up several interesting specimens of fossil remains of shell-fish of different forms and sizes, and procured others still more perfect, by breaking open loose fragments of limestone that had fallen down from the banks.

About 2 o'clock, coming to a portion of the river comparatively straight, we saw a herd of buffalo on the bank about two miles below, preparing to cross. They did not all descend to the water's edge at once, but one or two pioneers and leaders of the band kept in advance, apparently to try the bottom lest it should prove miry, and the whole herd get swamped. The bottom proving satisfactory, the leaders plunged in, followed by the whole band, who landed safe on the other side. One would think they found it very hard work, for in swimming they grunt so as to be heard distinctly a mile. Below this they have learned by experience to be very cautious in selecting a crossing-place, for the flats near the water's edge are sometimes nothing but quicksand, or tenacious clay, very difficult to work through. At one point, some distance below the mouth of Milk river, I saw five wolves hopelessly mired near a dead buffalo, who had met with the same fate. We went ashore, and found that the clay was so much dried up as to admit of our approaching their place of incarceration, when, by dint of prying with sticks and pulling at their tails, we succeeded in releasing them, so much exhausted as to be scarcely able to crawl. They must have lain there a week.

But to return to the buffalo: one of the men killed one, a fat cow, and we selected the finest parts and went on our way.

Camped about 3 o'clock. At about 5 p. m. one of the men, who had been out hunting, came in and said he had seen a "war party" of about sixty Blackfeet going into camp, just around the bend above us. Such neighbors are by no means pleasant; and not having any particular desire at that time to be kept up the most of the night watching our "traps" and talking about the "Great Father at Washington," which would have been the case had we been discovered, I gave them the slip by dropping down about two miles, and camping upon the foot of an island. Distance travelled to-day 28.7 miles.

October 2.—There are very few points now in the channel where a rocky bottom is to be found. The water is quite turbid, and snags and sawyers are of frequent occurrence. The general course of the river after passing the mouth of the Muscle Shell about two miles, is nearly due north for about ten; so that a long tongue of land is formed by the great southern bend of the river, which is not more than four miles wide. The banks on the south side of the river are still quite high and much broken, and a few scrubby pines and dwarf cedars are to be seen near their tops. Incrustations of glauber salt whiten the banks in many places; a peculiarity by no means local, but, on the contrary, of very general occurrence all along the river. On landing at noon we picked up some more specimens of fossil shell-fish, also some conglomerated fossil marine shells, in which the cementing substance was carbonate of lime. This fossiliferous region appears pretty extensive. What specimens I collected I picked up accidentally, as it was not my object to make a collection, had I had the means of carrying them. This afternoon we again entered the Mauvaise Terre, very similar to the Bad Lands already passed, except that the bluffs do not crowd the river so closely. Game is very abundant, especially beaver. One point was passed to-day, where, for more than a mile, they had cut down all the available trees on the banks: the diameter of some of those felled was at least 16 inches. Wolves and large gray owls are more plenty than they have been, judging from the din they keep up all night. Distance travelled to-day 29.5 miles.

October 3.—There was a slight frost last night, and this morning was bright and clear; and it has been fair all day, but to-night it is dark and murky in the west, as if preparing for rain. The adjacent country preserves the broken, barren character of yesterday. Fossils, similar to those collected yesterday, were noticed to-day; also spherical nodules of argillaceous iron ore, about as big as oranges, were found lying about on the surface in some localities. Some of these were simply spherical, made up of concentric layers; while others consisted of a number of spheres in combination, or of a scoriaceous mass of imperfect spheres about the size of a pea, or a little larger.

About 3 o'clock we passed a conical-shaped mountain, about a mile and a half from the river, which is so peculiar on account of its position and regularity of form, that it has become a landmark, and is called half-way between Fort Benton and the Yellowstone, though its distance is somewhat greater from the former than from the latter place. A great number of buffalo have been seen to-day, but no other game of any consequence. Distance travelled, 32.4 miles.

October 4.—To-day has been quite pleasant, notwithstanding the untoward appearance of last night. The river has now become quite similar, in every respect, to the Lower Missouri. It is nearly as wide; its bottom is sandy, and broad, shifting sand-bars render the channel about as uncertain. The adjacent bottoms increase in width, richness of soil, and density of growth. The bluffs on the north side have declined and receded very much, being now nothing more than the breaking down of the high rolling prairie to the immediate valley of the river. But to the south they are still quite high and abrupt, but have more grass on them. Several bands of elk, and some buffalo, were seen on the banks to-day, and one fine cow was killed soon after going into camp. Distance made, 31.3 miles.

October 5.—Was a warm, hazy day. The regimen of the river and topographical features of the banks remain the same as noted yesterday.

About 11 o'clock, as we turned a bend in the river, we saw a grizzly bear about a mile and a half below us, walking leisurely towards the river, probably after a drink. He appears to have discovered us, too, about the same time, and to have been somewhat confused in his own mind as to what to make of us. He probably had never seen such a craft as ours before; and concluding to look into the matter further, he took a seat to await our approach. When nearly opposite to him, he arose on his hind legs and looked at the novelty a moment, then, with extended arms and an open countenance, advanced towards us till the water was somewhat above his knees, and there awaited our approach. But he had not to wait long, for two ounce-balls from our rifles gave him a fatal wound, with which he was only able to crawl about one hundred yards, to fall, for the last time, a victim of misplaced confidence. He measured seven feet from tip of nose to tail—not over a medium size, if it is that. Buffalo, elk, deer, antelope, ducks, and geese, were observed in unusual numbers to-day. Camped about 4 o'clock in the Big Dry fork of the Missouri. Distance travelled, 25.5 miles.

October 6.—Remained in camp on account of high winds. The Big Dry river, near which we camped, is quite remarkable at this season; though its bed is four hundred and seventy-two yards wide, (about the width of the Missouri at this point,) there is not a drop of water in it. Its bed is composed of fine brown sand, like that of the Missouri, and it has a wide valley quite well wooded, and but for want of water, would be, in every respect, as respectable a river as the Missouri. During the early part of the season, it throws in a considerable amount of water; and even now, is said to contain a little above its mouth, which finds its way to the Missouri by seeping through the sands below the bottom.

October 7.—On the morning of the 7th we left the shore, with the pleasing anticipation of soon passing the mouth of the Milk river. The channel was found to be worse than it had been for many days, for the water was often divided by sand-bars into many channels of nearly the same dimensions.

About half-past 10 o'clock we passed "El Paso" Point, where the steamboat of that name had unloaded its cargo, the outfit for the Blackfoot trading-post in the summer of 1853. This is the highest point to which a steamboat has yet ascended the river.

About 2 p. m. we landed at the mouth of the Milk river, which, though very low, measured 120 yards in width. Its bottom is very similar to that of the Missouri at its junction; its valley is broad and well wooded. Distance of the mouth of the river from last camp, 21 miles.

The only objects of the survey of that portion of the Missouri to which the foregoing journal relates, was to ascertain its geographical position and to collect facts bearing upon its navigability by steamboats. The depth of water, and other important features, as found in the latter part of September, have already been noted; what remains now, then, to be spoken of, are the changes to which the river is subject at different seasons of the year, together with the conclusions to be drawn therefrom.

In this latter part, it is necessary to depend somewhat upon local information. It is, however, very reliable, as it comes from members of the Fur Company, who have lived in the country for years.

The fact of this part of the river lying near its sources in the Rocky mountains, would naturally lead one to suppose that the changes in its volume of water from month to month would be nearly the same, for the same month, from year to year. This is found to be the case as winter breaks up and warmer weather gradually comes on in the spring, the ice becomes rotten, and the river swollen by the melting of the snow in the valley; and as early as the first of May, the river is clear. Such is the great range of elevation, and consequently the great range of temperature, covered by this feeding reservoir of snow, that instead of melting in the short space of a month and swelling the river to a torrent, the process of melting commences with the valleys in early spring, and goes on gradually to higher elevations as the season advances, constantly diminishing, of course, till August, when all that has a sensible effect upon the river is expended, when it commences falling more rapidly till the latter part of September. The minimum additional depth of water above that of the latter part of September, according to the information above referred to, is as follows, viz: For the 1st of June, 3 feet; 1st of July, 2½ feet; 1st of August, 2 feet; and 1st of September, 1 foot.

It would then seem that, up to the 1st of August, there is water enough for navigation by boats of three-feet draught loaded; and up to the 1st of September, for boats of two-feet draught; and later than the 20th of September, for boats not exceeding eighteen inches in draught.

The velocity of the current upon the swiftest rapids was little less than five miles per hour. When the water is a little higher, however, the rapids are all lost sight of, and the current is nearly uniform, but rapid. What might be found to form a serious obstruction, as the water gets low, are large rolling stones sometimes left on shallow places; but as they rarely, if ever, weigh over a ton, they could easily be removed by grappling-hooks made for the purpose, with which a boat might rapidly hitch on to them and drop down to deeper water.

The boat required for low-water navigation should combine the following important points, viz: very light draught, and great power in comparison to it; great facility in making short turns, and ability to stem a current exceeding five miles per hour.

Soon after returning to Fort Benton, we visited the falls of Missouri, which lie in nearly a southwestern direction, about seventy-five miles by land from the fort. There are five principal cascades. The first, about three miles below the mouth of the Sun river, falls about twenty-five feet. The second, nearly three miles below the first, is a small crooked cascade of five feet eleven inches pitch. Immediately below is the third. Here, between high banks, a ledge, nearly as straight as if formed by art, runs obliquely across the river, over which the waters fall forty-two feet in one continuous sheet of four hundred and seventy yards in width. At the foot of this cascade, so beautiful for its length and regularity, is a small island, covered with willow, cotton-wood, and wild cherry. Half a mile below this again is the fourth—a small irregular fall of about twelve feet descent. There is a small knot of an island near the middle, and between that and the right bank of the river the ledge of the fall is very crooked, and the water reaches the basin below in two pitches. But between the island and the left bank, there is simply a succession of rapids; the stream then hurries on, lashed and churned by numerous rapids, about five miles farther, where it precipitates itself over a precipice of seventy-six feet in height. This is the fifth and "Great Fall" of the Missouri. The banks are high and abrupt on both sides, and above and below, deep ravines, with bare, steep sides, extend out into the prairie from one to two miles. But opposite the fall, on the north side, a narrow tongue of waving prairie runs near to the river, and breaks off in terraces to a small bottom below the cascade. The lower plain, embracing two or three acres, is a rounded point of land, which, with a rock-bound shoulder, half encircles the basin of the cascade, and for a short distance below confines the water-course to half its usual width. Near its head, a broken and disconnected ledge of rocks rises some thirty feet or more above the water; but lower down there is some soil, and a few scattered cotton-wood, willow, and cherry trees.

Below the falls there is a continuation of rapids, which become less and less frequent to the mouth of the "Highwood creek." Steep banks, about two hundred feet high, crowd closely upon the river, and on the north side are so cut up by precipitous ravines that it is almost impossible to keep near the water-course. From a few miles above "Highwood creek," however, to Fort Benton, the river-bends are longer, and the receding bluffs often have small intervals between them and the stream. These generally occur on the concave side of a bend. A quite extensive bottom of this kind is divided by the "Highwood creek." Should it ever be found necessary to establish a military post in this vicinity, this position would combine many advantages of location. The soil is good and grass is plentiful, both on the bottoms and on the adjacent high prairies. The banks of the creek near the river are well supplied with cotton-wood for fuel, while several miles higher up in the Highwood mountains, pine timber, for building purposes, is of easy access, and can be floated down the stream. This is where the fur traders get their building pine.

Below the mouth of the Highwood there are no rapids of any consequence to Fort Benton, and the river and its banks much resemble that portion of the stream between the fort and the mouth of the Marias.

C. GROVER,
Lieutenant United States Army.

Governor I. I. STEVENS.

FINAL REPORT OF LIEUTENANT C. GROVER, OF HIS EXAMINATIONS ON A TRIP FROM THE HEADWATERS OF THE MISSOURI TO THE DALLES OF THE COLUMBIA.

SIR: I have the honor to submit the following journal of my trip from the headwaters of the Missouri to the Dalles on the Columbia, embracing observations upon the depth of snow, and the general character of the climate during mid-winter along the route taken by the main party of the expedition under the command of Lieutenant Donelson.

After returning from the survey of that portion of the Missouri intrusted to my charge, I remained at Fort Benton, on the Missouri, until the second day of January, 1854. Up to this date but very little snow had fallen in this section of the country, and what had fallen covered the ground but a few days at a time. The weather, as a general thing, had been mild and even, and the stock of the Fur Company, though depending solely upon the range for subsistence, and without shelter or care, were in fine condition. The Missouri had for a short time in the month of December been closed with ice, but on New Year's was entirely open.

My instructions contemplated the use of dog-trains as transportation. On the first of January everything was prepared, with this end in view. We had four trains; each train consisted simply of a thin ash board, about ten feet long and ten inches wide, turned up like a sled in front, with four cross-bars from front to rear, to keep it from splitting and to lash packing-straps to. The loads were done up in long narrow sacks, to admit of being readily packed upon the trains. They consisted of the bedding of our party—five men in all—what cooking utensils were indispensably necessary, and our provisions, viz: twenty days' rations of hard bread, flour, and bacon, and a supply of sugar and coffee, and 165 pounds of pemican* for the dogs, which gave them an allowance of three-quarters of a pound each per day.

The dogs, eleven in number, such as they were, had been purchased from the Fur Company and the Indians. They were small, inferior, wolfish-looking animals, and mostly unaccustomed to draught, but nevertheless the best that could be had.

We had been looking impatiently for a snow-storm for some time; but as none of any consequence had fallen, on the 2d we left Fort Benton with empty trains on bare ground, with two extra men and four pack-mules, which were to accompany us to the commencement of snow, and camped on the Teton, eight miles from the fort.

January 3.—About three o'clock this morning the wind changed from the southwest to the northwest, and it commenced snowing, and kept it up, off and on, all day. We therefore did not move camp, but retired to a dense thicket, patched up a tolerable shelter, and awaited the end of the storm. The evening was still more squally than the morning, and at sunset the thermometer stood 6° above zero—lower than I had seen it before, this winter.

January 4.—At sunrise this morning three inches of snow had fallen, and notwithstanding the intensity of the cold, a slight breeze from the northwest brought occasional additions. We left camp at half-past nine, and having followed up the course of the Teton about eighteen miles, camped in a broad bottom sparsely covered with cotton-wood and willow. During the latter part of the day we had a slight breeze full in the face, and in consequence several of the party had their noses and ears more or less frosted. At sunset the thermometer was 16° below zero, and still falling.

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* Dried buffalo-meat pounded and packed in a sack.

January 5.—Sleeping was out of the question the latter part of last night. Our camp was open and unprotected, and we had no tent or other shelter from the sharp wind. The dogs, too, felt the severity of the weather as much as anybody, and no sooner had we gone to bed than all the spare corners of our beds were appropriated by some of them, who, from time to time, disturbed us with their noisy disputes with the outsiders upon the rights of the squatters. Unable to stand the cold any longer, I got up at 3 o'clock and stirred up the fire. The thermometer stood then 31° below zero.

About 4 o'clock the wind veered round to the southwest and freshened into a stiff breeze. After sunrise it increased rather than abated, and gusts of driven snow followed fast upon one another over the high prairies. The appearance of the morning determined me to remain in camp again to-day, for our next march will of necessity be thirty-eight miles over a high dividing prairie, in order to reach the nearest wood on Sun river. About noon two Indians and two squaws came into camp; the Indians were on foot, but the squaws were each mounted astride on an Indian pony. One of the ponies was also harnessed to a traveille—a very simple kind of vehicle much used by the Indians. It consists of two poles, about fifteen feet long for horses, lashed together at the small ends with leather thongs, and spread apart at the big ends in the form of a letter A. A strong strap is attached to the two shafts near their forks, which rests across the saddle on the horse's back,while the big ends drag on the ground. A short distance behind the horse's heels two or more cross-pieces are bound, to which the load is lashed. This arrangement forms the Indians' principal means of transporting their movables from point to point, and is equally applicable to horses or dogs, the only difference being in size. After sunset they caught up their horses again and left, having previously given us to understand, by signs, that they were on their way from Fort Benton to one of its outposts on the Marias, and that they intended to travel all night—a method frequently adopted by small parties in travelling, to avoid their enemies. I thought at the time that they ran as much risk of being frozen to death in the night as of being scalped in the day, and that there was very little choice between the two.

January 6.—This morning was quite clear, and much milder than yesterday. About sunrise we left camp, and by constant walking succeeded in reaching Sun river (38 miles) about an hour after sunset. It was a weary march, however; the snow was dry and just deep enough to make it slippery under foot. It concealed also beds of prickly pears, which were very thick in this prairie. These annoying things have barbs on them an inch long, and so sharp and strong that they will go through anything short of a thick boot. The men, who wore moccasins, were frequently obliged to stop and pull them out of their feet. Just before supper I threw my buckskin tobacco-pouch down on my bed, but, come to look for it a short time after, it was nowhere to be found. It was a great loss, for it contained my flint, steel, and pipe—my only pipe. I suspect the pouch went the same way as a pair of moccasins I carelessly left by the fire to dry last night—the dogs ate them. About eight o'clock the wind sprang up from the southeast, accompanied with a little sleet and appearances of snow.

On the morning of the 7th appearances were so favorable to a continuation of the snow, that I sent back the pack-mules and extra men, and transferred our provisions, &c., to the trains. The weight of each train was now about 175 pounds. This is a very light load for three good dogs, but quite heavy enough for ours. They went along, however, much better than had been expected. After travelling nine miles up Sun river, we camped early, in a point of cotton-wood, where we were to leave its valley.

The river is frozen over only at points where its course is sluggish. In the course of the day a number of white-tailed deer, antelope, and grouse were started up, but nothing was killed but a grouse. I begin to see that I was too hasty in sending back my pack-mules, for a breeze has been blowing from the southwest all day, and has taken off nearly all the snow. A southwest wind in this country is sure to bring with it fair, mild weather for the season, whatever it be; and as this is the most prevailing wind in the winter, the fact may account, in some measure, for the small amount of snow that falls, and its short duration.

January 8.—Travelled nine miles, and camped on a small creek. The ground is mostly bare, and travelling very laborious. Saw plenty of deer, but were unable to kill any; also saw a herd of buffalo about five miles to the south of our course. The wind continues from the southwest, and the weather is quite warm for the season.

January 9.—The weather continues warm and the ground bare, and the men have been obliged to cordelle on their trains all day. After making about ten miles, we camped in a small ravine a little after sunset, where we were able to collect enough dry willow to make a tolerable camp-fire. This afternoon a high ridge was passed, which afforded a full view of the main chain of the Rocky mountains. Their sides were white with snow, and their tops were enveloped with a dense wreath of clouds, from which the snow was falling heavily.

A large gray wolf has been following close upon our trail all day; he probably concludes, from our rate of travel, that we are about giving out, and wishes to be in at the death. A grizzly bear also followed us some distance; but he finally gave up the pursuit, unwilling to trouble his head about such small game.

The morning of the 10th was clear and cool. The clouds had risen from the lofty peaks of the mountains, and their broad sides stood out in blue and white, as thick forests of pine alternated with barren spaces of snow.

We left camp about sunrise, and labored on, as on yesterday, as far as Dearborn river; upon which we camped, in a narrow, sheltered bottom of cotton-wood.

This seems to be the commencement of snow in earnest; and right glad we are to find it, for we are heartily tired of bare-ground sleighing. Game is quite plenty here, but very wild. While at breakfast this morning, several small prairie wolves came barking around our camp. There is a marked distinction in size between this animal and the ordinary wolf of the prairie.

The "medicine" wolf, as the Indians call it, is not much larger than a large cat, and has received the name it bears from the general superstition among the Indians, and indeed among some trappers, that its presence, and particularly its barking about camp, bodes some great misfortune—the near approach of an enemy, or other dire calamity. Whether there are any such fatal accidents in store for us remains to be seen.

This evening the wind continues from the southwest, and the general appearance of the sky is stormy.

January 11.—This morning we commenced our march early, as usual. A slight breeze was blowing from the west, and a little snow falling; but, as we approached the mountains, the wind increased to a gale, and the snow fell fast and cutting. It was with difficulty, at times, that we could keep our feet, much less make any progress.

About noon we entered the defile or pass; it is walled in on both sides by high mountains, whose faces are more or less wooded with a diminutive growth of pitch-pine. At its bottom runs a small stream, which takes its rise immediately at the foot of the dividing ridge which separates the headwaters of the Missouri from those of the Columbia, and flows into the Dearborn river.

It would appear that the prevailing high winds which blow through this pass are from the west; for of the many thousand of dead pines that had been prostrated by them, not one did I see that was broken in any other direction than towards the east.

After having travelled about fourteen miles, we camped in a sheltered thicket of pines, near the foot of the dividing ridge. We were wet and cold, for since about 9 o'clock this morning we had been travelling in a blinding storm of damp snow, every flake of which imbedded itself in the furz of our blanket-coats, and, melting, wet us to the skin. But, in a pine growth, a few moments suffices a "voyageur" to make a fire. Two of my men were of this class, and therefore at home in the woods.

The method they usually adopt is, to shave off some of the outside bark of a green pitch-pine, and powder it finely in the hands. This is poured upon a chip or piece of bark, and a small piece of spunk, lighted with flint and steel, is covered with it. From a smoke, with the aid of a little blowing, it soon increases to a flame; and, with the addition of a few dry splinters from some fallen tree, the foundation is laid of as roaring a fire as any shivering traveller need wish to back up against.

A flint, steel and spunk, are always preferable to matches; the latter are too liable to injury from the damp.

After our fire got well to going we cut down some small pines, and used some to hedge up the windward side of the fire, while from the others were trimmed off enough boughs to make down our beds on. The snow at camp is eight inches deep, and some of it appears to have been on the ground some time.

Our friends the wolves continue to follow on our trail, and to look in upon us occasionally in the evening, not fully satisfied that we are all right yet.

January 12.—Last night about an inch of snow fell, but this morning was clear and very cold. With two hours' labor we succeeded in forcing our way, through an entangled thicket of young pines, to the foot of the dividing ridge—the back-bone, as it is called, of the main chain of mountains. The ascent was steep and laborious—so much so, that the men were obliged to double teams, and make two turns from the base to the summit. This occupied all of two hours, though the distance was not over half a mile. I therefore gained the summit some time in advance of the party. It was then mid-day, and the sun, which shone brightly in a cloudless sky, was surrounded with a succession of beautiful halos. The first, brighter than a brilliant rainbow, subtended, as near as I could judge with a pocket-compass, an angle of about 45°. The second, a very distinct one, though not so brilliant as the first, was concentric with it, and subtended an angle of from 60° to 70°. The third, an inverted arc, of which only about 120° was visible, was tangent to the second at its highest point, but had about the same curvature as the first.

The air was full of minute particles of frost, so small as to be visible only by their sparkling in the sun. The western slope of the ridge was nearly as abrupt as the eastern, and at its base was the fountain-head of the Blackfoot fork of the Bitter Root river, whose narrow valley wound its way westward till lost to view in the mass of surrounding mountains.

Here I proposed to stop a little, at the top of this connecting link of the immense mountain chain, to take an uninterrupted view of these valleys, with their small streams, which, though rising within gunshot of me, were tributary to two such distant and mighty rivers. But it soon became evident that this was no place for any one to stand idle, for a temperature of 21° below zero, assisted by a sharp west wind, drove me down the mountain side, with both ears and the end of my nose frozen. That was a very uncomfortable place.

A little after sunset we camped—perfectly tired out, from the biggest man to the smallest dog—in a bleak, dreary corner, with but few trees to break the wind. Our beds, which had been wet the night before, were frozen, and had to be thawed before used. As to myself, I did not lie down at all that night, but piled up a bank of snow, and scooped out a place in it for a seat, which I lined with my bedding, and slep bolt upright.

The snow for the most of the day has been one foot in depth, and is drifted but little; therefore it has not been found necessary as yet to wear snow-shoes.

January 13.—Travelled about six miles down the Blackfoot fork and camped. Some time last night a driving storm arose from the northeast, and has continued all day, filling the air perfectly full of flying snow. After camping, we occupied ourselves the rest of the day by building a large bough-house around the fire and drying our bedding. One of the men had his toes frosted to-day, and this morning two of the dogs, while being harnessed, had their feet so badly frozen that they are very lame. They have to be watched for a while after camping some nights, otherwise they will lame themselves by lying down and gnawing out the balls of snow which get packed and frozen between their toes in travelling.

There are some signs of beaver on this stream, but not many. There is not enough willow and cotton-wood about to please them.

January 14.—This morning the storm had ceased, but it remained extremely cold, and a slight breeze was blowing from the northeast. Since yesterday morning we have used snow-shoes, and, though the snow is not over a foot deep, find it easier travelling with than without them. The dogs, too, travel better in a snow-shoe track than in a single foot trail. Neither game nor any signs of game, except a few pheasants' tracks, have been seen since crossing the dividing ridge.

At the end of about eighteen miles we camped in an old Indian lodge, constructed of poles about four inches thick and twenty feet long, set up so as to form a conical structure. On the outside, to the height of about five feet, it was covered with bark and thatched with pine boughs. The fact of the top being left open, as well as of its being very strongly built, makes it probable that it was built by some war party of Blackfeet in making or returning from a predatory excursion upon the Flatheads. This is the route often taken by them in the summer, though they sometimes pursue a shorter and more southern one. In the winter they don't often make descents of this kind, on account of the difficulty of taking off stolen horses, but turn their attention more particularly to the Crow country.

The morning of the 15th was the coldest of the winter thus far. At sunrise the thermometer stood 38° below zero. This intensely cold weather is not very disagreeable to travel in, though inconvenient. One must take the precaution to rub his nose and ears once in a while, otherwise they get frosted without giving the least warning. Every particle, too, of moisture in the breath collects on the beard, and encases the lower part of the face in a shell of solid ice about half an inch thick, which it takes a long time to pick off after camping. Sometimes I had my mouth frozen open, and sometimes shut, according to the position it happened to be kept in for half an hour at a time. But in camp a little more temperate weather is much preferable. As it is now, the dogs crowd around the fire with the most uncompromising pertinacity till we get to bed aud asleep, when they pile in upon us; and if one is kicked off he makes war upon some smaller dog, who, being displaced, turns out his next inferior, and so on, keeping the camp in a continual howl till they all get settled again. This occurs so often in the night as to be very annoying.

Soon after leaving camp, the mountain which had heretofore receded so far from the stream as to leave a narrow interval of level bottom-land along it, closed in upon the water-course and made it necessary for us to pick our way for the most part upon the side-hills or take to the ice.

The latter seemed preferable, but the stream was so crooked, it is doubtful if we made much by it. The current is rapid, and there are many air-holes in the ice, about which otter-tracks are very numerous. This animal has a peculiar method of locomotion. On the ice or hard snow he invariably runs about ten yards, more or less, and then slides as far as his momentum will carry him.

After travelling about sixteen miles we camped in a point of timber in a bend of the river, where some cotton-wood was intermixed with the pine, and here, as is generally found to be the case wherever there is cotton-wood, were works of the beaver.

One tree they had felled was two feet in diameter at the section. About three miles from last camp we crossed the track of a wood buffalo; his stride, when walking, was about a yard. This animal differs from the buffalo of the plains in being much larger, wilder, and in preferring a wooded to a prairie country. They are very scarce in this latitude, but are said to be more plenty farther north, in the Saskachawan country. General depth of snow to-day, ten inches.

January 16.—Travelling about the same as yesterday, but the snow seems to diminish slightly as we go west. Continued on the river till about 2 p. m. to-day, when we again took to the prairie, where the mountains open out a little, and by that means cut off a big bend which was about ten miles across. Some grouse were seen to-day for the first time west of the divide.

A band of wolves favored us with a serenade last night, and continued their politeness by escorting us on our way to-day.

Our dogs are nearly famished—poor fellows—but we are unable to increase their allowance. We have to hang our trains and harnesses up in trees at night, to keep them from eating off the raw-hide straps and buckskin strings. They have already managed to steal and eat two harnesses, all except the collars. Travelled about twenty-five miles, and camped on the river.

On the 17th, travelling was very bad all day, and we made but poor progress. The banks are often very broken and abrupt on one or both sides, and there are many rapids in the river where the stream does not freeze at all, and these generally occur where the banks are worst. Some places seemed impassable either by land or water. We sometimes found it necessary to pass where the water had overflowed the ice a few inches; this would wet the bottoms of the trains, and the moment they struck the snow again a portion of it would freeze to them, and no amount of scraping would make them run as easily as they did before.

Last night it clouded up, and has remained cloudy ever since, and a little snow has fallen from time to time.

Saw a few ducks along the river, and now and then the track of a marten on the banks; also saw a black squirrel, on a pine tree, as we came into camp. This is not the first I have observed, however.

January 18.—We were so fatigued by yesterday's march that we overslept ourselves entirely last night. In fact we did not wake up till 10 o'clock in the morning: this, with a little accident that happened, detained us till about noon.

The dogs or wolves, one or both—for they are on very good terms with each other—managed to pull down one of our trains from the tree in which it was hanging, and ate off every particle of its rigging, leaving us nothing but the bare boards.

The men set about repairing the mischief with all possible despatch, but at the same time expressed themselves in no very amiable terms with regard to the perpetrators, as I judged from the frequent use of the expression, "*Sacre maudite chien*," and the like. After making about six miles over a route very similar to that of yesterday, we camped about half a mile from the river. The weather has been clear and bright for the most of the day, but towards evening it clouded up and a little snow is falling.

On the morning of the 19th we left camp about an hour before sunrise, in order to make up in some measure for our idleness of yesterday. The river has now become quite a stream. I did not measure its width, but estimated it to be about one hundred yards. Sometimes it rushes over ragged rapids with great impetuosity for a distance of half a mile, enclosed on both sides between banks composed to the water's edge of hanging crags and big loose rocks. It was often a matter requiring some ingenuity and risk to get along at all.

There is a trail somewhere along the right bank; but as I have no guide, it is out of the question to follow it, covered as it is with snow. At other points, generally on the concave side of some long bend, the banks fall back in a gentle slope for a mile or so to the base of the mountains. On some of these inclined intervals I observed a great many buffalo tracks leading from the mountain defiles to the water. This somewhat surprised me, as I was under the impression, from what I had learned, that no buffalo lived in these mountains.

As I was picking my way along the river towards evening, some distance in advance of my party, an otter popped out of an air-hole near me and commenced playing about and smoothing down his sleek coat on the hard snow. I had nothing but my pistol with me, having left my rifle behind on one of the trains; but unwilling to lose my chances at him I fired, and he slid back into the water, but soon reappeared and continued his diversions, upon which I fired again with no better effect. After the third shot I went off and left him to his amusements, satisfied that my chances of killing him were not worth the powder and shot. This was the first one I had had the opportunity of seeing distinctly. His head was rather elongated and small in comparison to his body, which was long and rather disproportionately large behind. His legs were short, and his feet large in comparison.

About sunset we camped. I had expected before this to have reached the mouth of the Bitter Root river, which we are to ascend about thirty miles to get a new supply of provisions; but as yet I am entirely uncertain how far we may be from it, which is the more unpleasant as we are nearly out of provisions. The poor dogs ate the last of theirs last night, but they are half-starved and weak, and must have something; so, as a last resort, we boiled part of a raw elk-skin, so as to give each a piece about eight inches square.

The weather, though pleasant otherwise, still continues from 10° to 20° below zero.

January 20.—This morning we found our provisions reduced down to a few pounds of flour and a little coffee. We did have a small piece of bacon left last night, which one of the men rolled up in a bag, and put under the head of his bed for safe-keeping. But it seems that one of the dogs, by an artful manœuvre, succeeded in extracting it, and appropriated it to his own use. How to cook our flour was now the question—a difficulty that looked big at first, but vanished at the recollection that we had a few candles left. The flour was made into a batter with water, and fried in the grease of the candles; and it made pretty good pancakes, too, but still might have been improved with a little salt and saleratus.

Travelling to-day was worse, if anything, than yesterday; and, though we kept at it most diligently all day, we probably have not made more than eighteen miles. Buffalo tracks continue to be observed, but in less numbers than yesterday.

I have been in the habit of taking my rifle to bed with me, but last night I stood it up against a tree near at hand; but when I looked for it this morning it had been dragged some distance in the snow, and the cover was gone. The theft, as usual, lies between the wolves and dogs, and, though very annoying, I can't help admiring the power of their digestive organs; for, notwithstanding the rifle-cover was made of the thickest lodge-skin, there was not a string of it to be found anywhere.

Two of the dogs are very lame to-night from the effects of frozen feet. The snow has gradually diminished for the last few days, so that at present there is nowhere over eight inches.

January 21.—Last night soon after dark a smart breeze arose from the northeast, and it commenced snowing; and this morning about an inch had fallen. It continued also to-day till about noon, when the wind changed to the southwest, and brought with it fair weather. Though detained some time in fitting up a harness to replace one eaten by the dogs, we left camp about our usual time. About 10 o'clock, much to our satisfaction, we struck the junction of the Blackfoot with the Hell Gate fork of the Bitter Root river.

The latter fork comes in from a southeastern direction, and is of about the same size of the former. This junction is what I had been anxiously looking for for several days, and we should have struck it three days ago had my estimate of distances been correct; but we have been under the necessity of going much out of our way at times, and, having no guide, my pocket-compass and incomplete map were found to be inadequate to an accurate determination of our whereabouts. Indeed, I had begun to think that we might possibly have passed both the junction of the two forks and the mouth of the Bitter Root river, and were following down Clark's fork—no pleasant reflection, provisioned as we were. Continuing on, we camped late in the evening on the Bitter Root river, where for supper we gave our dogs the last morsel of raw hide and old moccasins we had, and ate the last of the flour, with the exception of enough for breakfast.

As we debouched from the mountains into Hell Gate defile, as the valley of the Bitter Root is sometimes called, the temperature was much milder, and the snow decreased to about eight inches in depth. I turned round to take one last look of the cold defile we had just left. Clouds of vapor were rising from the valley of the stream, and enveloped the tops of the enclosing mountains; and as the rays of the setting sun played upon their changing wreaths, and fell warmly upon the backgrounds of pine, the prospect was much more agreeable than experience had shown the reality to be.

January 22.—Made a very early start, for we were well aware that we had a hard day's travel of about thirty-five miles before us. Soon after leaving camp, in following up the Bitter Root, we struck a well beaten Indian trail, and by following it we found travelling much better. Though a bare place in the valley was found now and then, the snow was generally about six inches deep. Early in the afternoon we met a large party of Indians going to hunt. They were the most intelligent-looking and mannerly Indians I had yet seen. Some of them could talk English quite well, and even those that could not understand a word of it had learned the expression "How d'ye do?" which they did not fail to repeat once or twice in passing.

Late in the day we stopped at a camp-fire by the side of the road, at which three young men were seated. Upon seeing our pipes, they asked, by means of signs, for some tobacco. I handed one of them quite a large piece, from which they filled their pipes, and returned the remainder—something I never knew an Indian offer to do before.

About 4 o'clock we arrived at the hospitable establishment of Messrs. Owen. It was with feelings of the greatest satisfaction that we again found ourselves under a roof; and that pleasure was thrice enhanced by the open-hearted cordiality with which we were received.

In the valley we delayed until the 30th—one day passed at Fort Owen, the remainder at Cantonment Stevens, where Lieutenant Mullan has established his winter quarters fourteen miles higher up the river. Between these two points the valley was broader than below Fort Owen, and on each side of the trail knots of cattle and horses were grazing contentedly on the wide range The cattle, though never housed or fed, were, with few exceptions, in market order; and young calves, which had never looked beyond their mothers for protection and care, were sporting in the sun.

Near Cantonment Stevens were several lodges of Flatheads; and, during our stay there, we were visited by many of that tribe, who were anxious to hear the news from the other side of the mountains, and to learn if the Blackfeet were still at war with their neighboring tribes. They had so often entertained delusive hopes of peace, and so often trusted to treaties and promises which had as often been broken at the pleasure of their treacherous enemy, that they had well nigh despaired of ever living in their own country unmolested.

These poor Indians, whose boast it is that "they never shed the blood of a white man," are, on account of their peaceable dispositions and their wish to follow the counsels of the whites, almost incessantly harassed by their more powerful neighbor across the mountains. Every year bands of their horses are run off, and more or less of their people fall victims to their lurking foe.

From information obtained here, it was found impracticable, from want of snow, to continue further with our trains. On the 29th, therefore, two men, who had contracted to come only this far, were sent back with one train and four of the best dogs, and the remaining dogs were cast adrift to return to their natural masters, the Indians.

I was also told by the Indians that it would be impossible to reach the Pend d'Oreille lake with horses, on account of the deep snows near that lake and want of grass for many days; but, aware of the magnitude which a small difficulty assumes in the eyes of an Indian, contrary to their counsels, a sufficient number of horses and mules were received from Lieutenant Mullan, and eight bushels of oats and barley were bought for them from Mr. Owen, when, with the addition of one man from Mr. Mullan's party and an Indian guide, preparations were made to leave the next day.

After this reorganization, with three men and an Indian guide I left Fort Owen on the 30th, and recommenced my march towards the Pacific. I shall not soon forget the unostentatious hospitality of its proprietors, nor their kindness in furnishing me with many little conveniences and comforts for my journey, which I should otherwise have been without.

After travelling about ten miles we camped. The weather is very moderate, and the little snow still in the valley is fast disappearing.

The morning of the 31st was quite warm and cloudy, with a breeze from the southwest. About noon it commenced drizzling, and continued rainy for the rest of the day. The snow is nearly all gone, and has left the ground covered in many places, especially on the side-hills, with glare-ice—a great inconvenience to unshod animals. In course of the day we crossed the river three times, twice by fording and once on the ice. At our first crossing, soon after leaving camp, the ice extended from the banks into the stream some distance on both sides, leaving the deepest portion of the channel unfrozen. The horse of my guide, Paul, who rode in advance, plunged in without hesitation, and I observed that the water only came to the knees of his rider as he sat in the saddle. Not supposing that there would be much difference in depth anywhere in the immediate vicinity, I allowed my pony, who was very much disinclined to trust himself to the current, to pass too much to the right before plunging in; by which piece of indiscretion, due partly to the horse and partly to myself, we got off soundings, and both went completely under. The occurrence, which in itself was sufficiently disgusting, was rendered more so by seeing Paul on the other side, with his hand over his mouth in token of amazement.

At about sunset we camped at the foot of Hell Gate, near the mouth of the Hell Gate river.

February 1.—The rain, which commenced falling yesterday, continued till about 2 o'clock this morning, when, with a change of wind to the northwest, it changed to snow, and about half an inch covered the ground this morning at daylight.

Early in the day we left the Bitter Root river, and passing through a narrow gorge in the mountains, called the "Defile of Coracah," struck the river Jocko, upon which at night we camped. In this defile there was about eight inches of snow, but none in the small prairies.

February 2d was clear and beautiful. Our way to-day has led through a succession of defiles and small mountain-locked prairies, covered with good grass. Upon some of these, bands of Indian horses were grazing at large. They were all well-conditioned, and many of them fine-looking animals.

About noon we passed two solitary lodges of Nez Perces Indians. As the sun descended behind the hills we again camped on the Flathead river, having travelled about twenty miles.

February 3.—To-day we followed down the river till about 11 o'clock, and crossed. It was frozen over so smoothly that it was found necessary to make a pathway for the animals, to keep them from slipping. This was done by strewing sand from one side to the other; it answered the same purpose as ashes. But this was not the only detention met with here. While we were engaged in making our path-way, one of the pack-mules stole off from the band unobserved, and cached himself behind a knoll, in an out-of-the-way place, where it took a full hour to find him. Late in the evening we camped on "Camash Prairie," a high round prairie, enclosed in mountains, about eight miles from the river. To-night is stormy.

February 4.—The feed was rather short last night, and in consequence the animals strayed a good deal. For two or three of the first nights some of the horses were hobbled, and it was found sufficient to keep the band together and near camp. In a mixed band mules will not often separate from the horses; but after getting completely out of their range, they have been allowed to roam at large. About noon we passed "Horse Plain," a broad interval included between the river and the mountainous country back of it. There were upwards of forty horses grazing upon it. These small prairies generally furnish thick nutritious grass, and afford to the Indians very convenient natural enclosures in which to winter their horses; for the broken country immediately about them is generally almost destitute of feed, and other natural obstructions render it very difficult for them to stray, were they inclined to do so. Though they are not looked up from the commencement to the end of winter, there is no danger of their being stolen, for the Indians frequenting this part of the country have very just notions of property rights.

Upon leaving "Horse Plain" the trail followed down the river for the rest of the day. At one point a sharp shoulder of rock abutted into the river, and the trail wound over the ridge back of it. On the side of the ascent the sun had melted the surface of the frozen ground in course of the day, and had made it so slippery that, all we could do, we could not contrive to get our animals up it. They would pick their way carefully about two-thirds the way up, and then slide back to the bottom. After abandoning the attempt, we succeeded in getting them round the point of rock on a narrow strip of ice.

Since last night it has been cloudy, and a little sleet has fallen from time to time. Camped about four miles from "Horse Plain."

On the 5th, travelling was unusually bad. The trail, for the most part, threaded along the river bank, through dense thickets of pine, and was often covered with ice, so that the pack-animals were constantly slipping down, or bolting from side to side against trees, and wrenching off their packs and spilling the contents.

About the middle of the day we came to a place called "Bad Rock," where a mountain cliff crowds itself into the river, and the trail winds up its jagged side in a serpentine course to the height of about five hundred feet, and down an equally precipitous face on the other side. The ascent is bad enough, under the most favorable circumstances; but now, ice in the path made a portion of it impassable for animals without assistance; but ropes were made fast round their necks, and by dint of pulling from above and whipping from below, one by one we forced them up. All these extraordinary proceedings amused Paul very much, and he frequently exclaimed, "Es-em-mowela," (bad rock.) I felt strongly inclined to pitch him down the hill for hinting that I didn't know that without being told.

After crossing a small stream called by the Indians "In-shanshe," we camped on "Thompson's Prairie." This prairie is an interval between the river and the mountainous country inland, and has been made the depot for the horses of one or two parties which have gone west this winter, under the impression that, on account of deep snows and want of feed, it would be impossible to take them much farther.

There is some snow here, but not much. To-day has been very clear and pleasant.

February 6.—Remained in camp to give the animals a little rest and recruiting before entering the pine desert before us. Sent Paul and one of the men across the river into a timbered bottom to hunt deer, but they were unable to find any. The deer, what few there were, appear to have been driven back into the mountains, for there are no fresh tracks.

February 7.—Upon leaving "Thompson's Prairie," we entered that dense pine forest which extends without interruption to Pend d'Oreille lake. The influence of the sun, especially in the winter, when his rays fall more obliquely, is very imperfectly felt through the thick foliage, and the snows from the time of their falling lie entirely undisturbed through the winter months.

From the commencement of snow, at "Thompson's Prairie," it has been gradually on the increase during the day, and at camp to-night it is one foot deep. Had the ground been bare, it would have been no better for our animals, for the forest, at best very meagre in undergrowth, was overrun by a fire last fall, which swept it clean of every blade of grass and green thing. Without feed, then, the animals were tied to keep them from returning on the trail.

Early in the afternoon we passed a small camp of five lodges of Pend d'Oreille Indians. They were the most destitute, squalid, miserable-looking human beings I think I ever saw. Their lodges, which were low and badly constructed, were made of poles set up in the usual form, covered with rush matting.

Upon approaching the lodge doors, we were greeted with the usual outburst of yelping dogs, followed by the inmates of the lodges. One-eyed and distorted old men, toothless old women, and naked children, all besmeared with filth, crowded round to shake hands with the *tyee*. I began to fear we might get short of provisions before getting through, or I should have passed them by unnoticed; but as it was, I swallowed my disgust, and bought about twenty pounds of venison—all they had to spare—for which they received in return some powder and balls.

Last night it rained some hours, but turned off cool and windy towards morning. Camped on "Steep river."

February 8.—This morning about two bushels of oats and barley were fed out to the animals, which allowed them a little over four quarts each. Some of them chewed off their pack-straps with which they were tied in the night, but did not stray, as but few got loose.

We have passed to-day several old Indian camping places, indicated by the skeletons of their lodges still standing. At one of them was a mud-built structure about six feet long and three wide, arched over at the top like an oven, and lined inside with pine boughs. At the end was a hole sufficiently large for a man to crawl in. It was probably the dormitory of some bachelor Indian.

Though the great mass of the forest growth is pine, there are some hemlock and fir; and on the banks of small streams, and near the river, a few cedars, white and yellow birch. Some of the cedars were as large as six feet through at the butt, tall and straight-grained. The snow is still increasing a little in depth, but does not as yet offer much of an obstruction to travelling. It varies to-day from twelve to eighteen inches. The weather is still cloudy, and a little sleet has been falling from time to time. Travelled to-day about 14 miles.

On the evening of the 9th, after having travelled about as far as the day before, we camped on a small stream whose banks were fringed with hemlock and cedar. A sufficient quantity of them were felled and their boughs fed to the animals. They would pick at them a little, but more from force of habit than from any relish. They preferred hemlock to cedar.

We have given up riding altogether, for travelling is getting bad, and we wish to save the animals as much as possible.

The snow is now from eighteen inches to two feet in depth, with a light crust over it. For two days past I have frequently observed tracks of an animal called in this country the panther, or tiger-cat. The tracks in the snow are about as large as a saucer, and the stride of the animal, as he trots, is about two feet.

Last night it rained for several hours, but turned off towards morning to snow, and it was stormy all the morning. It is still cloudy, and threatening rain to-night.

February 10.—My guide, Paul, seems to be totally unacquainted with the trail, now that it is well covered with snow. In consequence we have followed the bed of the river all day. Though the channel is not frozen over, there is a strip generally along the edge, a few feet wide, which answers very well to travel on, provided the animals are closely watched. Notwithstanding every care, they will sometimes get in. Just before halting for the night we passed a camp of eleven lodges of Pend d'Oreille Indians. The lodges were similar to those passed on the 7th, but the inmates were a little cleaner and better clad; but they all appear to be on a short allowance of soap. After supper they brought some venison into camp, to "swap" for anything we might feel disposed to give them. With some powder and balls, and a few old shirts, I purchased as much as I wished.

We found a few cotton-wood trees near our camp to-night, and felled them. The poor animals ate the browse with great good will. Since 9 o'clock this morning it has been raining lightly, and bids fair to continue some time.

February 11.—We continue to pick our way along the river. When a few miles from camp, an old Indian camping-ground was passed, which, from appearance, had not been deserted long. In its midst was a scaffolding, erected by making four poles fast in the ground in an upright position, at the corners of a rectangle, and lashing cross-poles to them about eight feet from the ground. These latter supported a platform, upon which, in a rude enclosure, was the body of a deceased Indian.

There was another structure near by, built of logs, matched and jointed at the corners like a log-house. It was about seven feet long, four feet wide, and four feet high, and closely covered at the top. This I took to be also a place of sepulture.

The average depth of snow to-day was from two feet to two and a half.

February 12.—A few miles before reaching our camp last night, the trail leaves the river and takes a short cut to the Pend d'Oreille lake, over the Cabinet mountain; but my guide, Paul, has entirely lost his reckoning, and rather than attempt to cross it blindly, I preferred the chances of being able to follow the river. The way along-shore has become very difficult and hazardous of late; the river falls more rapidly than before, and often boiling rapids and rugged shores of loose angular rocks, with the crevices and chasms between hidden with snow, make our progress extremely laborious and dangerous to the animals. We left camp early this morning, and felt our way along the bank for about a mile, during which time nearly all my mules got in once or twice apiece, and we were detained some time in pulling them out, by lariats thrown over their heads, and in readjusting their packs.

One accident of this kind—though it came near costing me two of my best mules, and nearly all our bedding and provisions—struck me as being extremely ludicrous. Two of the mules, with their usual contempt of prudence, bolted out of the track on to a long point of ice formed at the head of a sharp bend, and when near the extremity, their weight, of course, broke it off, and they swung out into the swift current on a raft of their own constructing. As they separated more and more from their comrades, their long ears began to revolve about on their skulls, indicating that an idea had struck them that they were getting too far from shore, when, with a mutual look that sufficed for a parting shake of the hand, they plunged into Clark's fork of the Columbia. The last I saw of the companions-in-arms was the tips of their tails before the last wave closed over them. At the expiration of a few seconds two noses appeared, followed by four ears and the packs. But they swam ashore, and allowed themselves to be pulled out just in time to save themselves from going over a churning rapid below.

I thought the last demonstration might wind up the subject of river travelling for the present, and struck into the timber. We had now before us a broad bottom, lying betwen the Cabinet mountain and the river, and covered so densely with pine that we had to grope our way along, bushing out as we went, and turn from side to side to avoid fallen timber. The snow was from two to two and a half feet deep, with a crust on the top hard enough to nearly bear, but not quite. As our snow-shoes had long since been broken to pieces on the pack-animals, we went on, putting one leg in and pulling the other out, till nearly sunset, when we ascended the mountain-side a little, and camped in a small opening.

This has been the most laborious day since leaving the Bitter Root valley, and yet we have not made over six miles.

To-night our animals are a sorry-looking set. There is not a particle of anything for them to eat at camp, and they ate the last bite of grain yesterday morning. Their bellies are so drawn up, that with the greatest care a pack-saddle cannot be made to stay on more than two hours at a time. They have endured almost an incredible amount of hardships. Though jaded to commence with, they have been knocked about from day-dawn till dark over rocks and ice, and through a pathless pine forest, with almost nothing to eat for the last six days. Their legs, cut by the snow crust, are raw and bleeding from fetlocks to knees. This is the state of preparation for a hard jaunt to-morrow, which, if we are fortunate, will bring us to grass. Our beds are thoroughly saturated with water; but, exposed as we are to every storm, we have long since ceased to think of dry beds or clothes.

While ascending the mountain-side, I shot a wood or yellow-breasted marten, as he sat upon a pine limb about forty feet from the ground. It has been snowing nearly all day, and to-night is dark and stormy.

During the night about two inches of snow fell, and on the morning of the 13th we continued on over a country the very pattern of that traversed yesterday, except that now and then a small mountain-stream was crossed, upon whose banks were many huge cedars. I noticed some that were eight feet in diameter six feet from the ground. They were also straight-grained, and had scarcely a limb to their tops.

Near evening we struck a beaten snow-shoe track, sufficiently hard to bear the animals; and, after following it about two miles, we entered a small opening near the lake and camped. Here we have the satisfaction of turning our emaciated animals into grass. It is poor yet, but the animals have ceased to be over-nice in what they eat.

On the 14th remained in camp to recruit our exhausted animals a little. The day broke clear and beautiful. Nature threw off the dark, gloomy aspect that had hung upon us for the last eight days, and shone forth with additional brilliancy. Early in the day an Indian dropped in upon us accidentally. He intimated that his band (Pend d'Oreilles) were camped about four miles from us.

After exchanging a few gutturals with the guide, he left, but returned again about 10 o'clock with six more, who sat around the camp-fire, smoked, and made themselves at home till about noon, when they all left except one forsaken-looking old vagabond, who laid about in the ashes all day.

I could not help noticing this aboriginal particularly. He was the rarest specimen of multiform and complicated filth I ever saw, and looked as if he had been dead for the last two years, and had left his grave for a morning walk without stopping to wash himself or change his clothes. He remained back to beg and smoke; but as I didn't feel disposed to see the stem of my pipe sticking in such a face as his, he was left unnoticed. After half an hour lost in silent expectation, with a combination of gutturals and gesticulations from his seat in the ashes, he commenced a long harangue, which, from his pantomime, I interpreted as follows:

"He was the friend of the white man; in fact, he loved the white man. And when the white man passed to and fro he always went to his camp, and smoked the white man's pipe, and ate some; in fact, he sometimes ate a great deal. And before he left the white man's camp the white man always gave him some tobacco and old clothes, and sometimes a blanket or two, or a buffalo-robe. If it was only a good blanket, he didn't care if it was not new, or what color it was. He was very glad to see me at this time, to-day, and was considerably hungry."

By this time I had finished skinning a marten that I had been engaged on all the morning, and was about to throw away the carcass, when he begged it, stuck it on a stick whole, and roasted and ate it. After this savory meal, he spit upon his hands and rubbed them over his face, and wiped his hands and face on almost his only garment—a tattered buffalo-robe. I was unable to perceive whether his face or the buffalo-robe gained the more dirt by the operation, but it had the effect to polish off the outside stratum on both.

At supper, it may be anticipated, he was not an invited guest; upon which he arose, and stalked off with great show of offended dignity.

This afternoon it became cloudy, and is snowing a little this evening.

February 15.—Early this morning we again resumed our journey. For the first few hours our way led through a defile between the main body of mountains on our right, and one which projected into the lake, forming a promontory on our left. Upon leaving this defile we came in full view of the lake, perfectly becalmed in its mountain-bed. Its form was irregular; sometimes it stretched out long arms into the blue distance, while at others bluff promontories, with their hard outlines, extended far into the heart of its waters.

We now followed the lake shore, and, after passing several small openings with fine grass, we camped at night in excellent feed at the mouth of Pack river. This is a small stream, emptying into the lake from the north through a flat open interval.

The snow, which was fifteen inches deep at our last camp, has rapidly decreased to the depth of four inches to-night. Last night one inch and a half more fell.

On the 16th we travelled about fifteen miles, and camped in a sandy point at the foot of the lake. In the latter part of the day the trail led round an arm of the lake, which was frozen over, and we saved about five miles by crossing on the ice. It was about eight inches thick, and perfectly safe, except where the rise and fall of the water had rived long seams in it. In crossing one of these, the mules suddenly rushed into one mass, and four of them went through; but they were released without loss or damage, excepting the thorough saturation of our beds, provisions, &c.

Ducks, geese, and otter are very numerous along the lake shore. I shot one of the latter, but he sank and I saw no more of him. The animals are very tired to-night, and some of them are evidently about giving out. My horse in particular was so much exhausted that he did not reach camp till half an hour after the others. The grass is thin and poor.

February 17.—My horse was unable to go on this morning, and one of the mules gave out before proceeding far. Their saddles and equipments were packed upon another animal, and they left to shift for themselves. Travelling was tolerably good, and notwithstanding the weakened state of the animals, before night we placed sixteen miles between us and the lake.

Near camp to-night, which is under a hill nearly destitute of grass, are two Indian graves. One is enclosed in a rough pen of small sticks of timber, while round the other there is a circular stockade about ten feet high.

There has been a slight increase of snow since leaving the lake; its depth varies now from eight to fifteen inches.

February 18.—After following along the river bank about three miles farther, we reached the crossing. The river here is deep and wide, and its current scarcely perceptible. A Mackinac boat was lying on the other side, and while constructing a raft to avail ourselves of it, the mules were unburdened and allowed to pick up what little they could by cropping the few heads of grass which here and there struggled through the snow.

A few minutes sufficed to put us in the possession of the desired conveyance; and after transporting our "traps" to the other side, two of the strongest animals were taken in tow, and the rest, once driven in, followed in our wake without accident to the other side. This is a deceitful crossing-place; owing to the width of the river and its lazy current, many animals have been lost this year in swimming it.

Here again we camped, poor as was the feed. I preferred remaining to going farther, and perhaps faring worse.

February 19.—The trail from the crossing of Clark's fork of the Columbia to the Spokane prairie leads through a depression of the range of mountains skirting along the left bank of the river. This valley is thickly though not heavily timbered with pine, and its northern and southern slopes are threaded by two small streams, which, in their winding courses to the Columbia and Spokane rivers, from time to time spread out into small lagoons.

By the summer trail, it is but two short days' travel through this forest; and with the comfortable contemplation of soon leaving this uncomfortable region, we followed up one of these streams to Lake Debosey, where, trusting ourselves to the guidance of Paul, we branched off into the timber. From this time till we reached the Spokane prairie, four weary, irritating days, we wandered blindly about over fallen timber, and through almost impenetrable thickets. The guide, deprived of any indication of a trail by the snow, was perfectly ignorant of its whereabouts. The snow, as we penetrated farther, gradually increased to the depth of two and a half feet, and its surface was covered with a crust which cut the legs of the animals so severely that I soon found it necessary to stop and tear up our extra bags for leggins. These I managed to wrap round their legs, and secure by tying under the fetlocks and just above the knee-joint. Still every step in the hard snow was marked by their blood, and they were so weak and spiritless that without a beaten path they would not move an inch. Two nights out of the three, we camped under some partially bare side-hills, where a little grass might be picked up, but the third was perfectly destitute of any. I was surprised at the endurance of the animals, which, I think, was tested to its foundation; for when we reached the prairie I don't believe there was one in the eleven that could have continued a fair day's march farther.

On the evening of the 22d, then, we emerged from this second and last snowy desert, and had the satisfaction of surprising our shadowy beasts by introducing them to as good a field of grass as their most extravagant imaginations could wish. In fact, the moment we debouched from the timber, we seemed to have transported ourselves by a single stride from the depth of winter to the refreshing commencement of summer. There were but few traces of snow left on the Spokane prairie, and already the slim spears of green grass were shooting up plentifully.

February 23.—We crawled along ten miles farther, and camped near the lodges of Antoine Plant, an old mountaineer, and an Indian herdsman, who lead pastoral lives, herding numerous cattle and horses on the adjacent plains. In course of the evening I succeeded in hiring ten fresh horses from Antoine, and in engaging his personal services as guide to Wallah-Wallah, vice Paul, cashiered.

My own animals were left in charge of the Indian till called for.

The sun had passed the meridian on the 24th, before we left Antoine's "ranche." The morning was passed in replenishing our larder with beef, from one of Mr. Owen's fat heifers. When we left the Bitter Root valley we had provisions enough, on ordinary allowance, to last to Wallah-Wallah; but notwithstanding many pounds of venison has been bought, we are entirely out. Our appetites have been in proportion to our exposure, and at times prodigious.

By 1 o'clock we were again on the road, and two hours' ride on our vigorous animals brought us to the right bank of the Spokane, a distance of fifteen miles, when we camped.

In passing, I took occasion to notice particularly the stock running at large. It was in about the same condition as that in the Bitter Root valley, fat and sleek.

To-day has been the first entirely clear day since leaving Fort Owen.

February 25.—The appearance of the Spokane river was not pleasant this morning. It is rapid at all times, but now, swollen by recent rains, it rushed by with a defiant whirl. In we went, however, and, thanks to strong ponies, by fording and swimming we landed all right on the other side. Our packs readjusted and squeezed free of surplus water, we gave rein to the horses, and were off at a sharp trot. The trail threaded an undulating, gravelly country, occasionally broken with ragged outcrops of trap, and half clad with stunted pines, which yearly dispute their claim to the soil with the autumnal prairie fires. Five miles on our way we passed the "falls," but at too great a distance for a satisfactory view. The river banks both above and below were high, and the right bank stretched off many miles to the north in a gently undulating plain, upon which, at a distance of five miles, could be seen the Spokane camp, surrounded with its thousand horses.

Just below the falls, where a bar divided the channel, the Indians had constructed wing-walls of loose rocks across one arm, leaving a race between their extremities, in which, by means of nets, they caught salmon in passing. A long trestle-work was also built on the bank, upon which their captives were laid to dry.

At noon the heavy leaden clouds which had overhung the earth from sunrise commenced to repay us for yesterday's fair weather, with most plentiful drenchings of snow and rain—a course of treatment kept up for the rest of the day.

At the end of thirty miles we camped, and made ourselves passably comfortable by spreading our saddle-blankets on a frame of poles on the stormy side.

February 26.—Last night the beasts took it into their heads to see more of the surrounding country than was consistent with an early start; but we made up for lost time when once on their backs, and camped early, after a forty miles' ride. The first quarter of our day's journey presented the same characteristics as that of yesterday, but in a more decided form. The outcrops of trap were more numerous, and often vertical walls of columnar-basalt supported the edge of a more elevated terrace, or bounded the sides of a detached knob. The soil is mostly composed of the detritus of trap, and has much oxide of iron in its composition. In a steep, craggy-sided basin we passed a small salt lagoon—the only one, my guide said, in this section of the country.

Presently the country opened out into a broad and swelling prairie, and the last vestige and remnant of pines were left behind. On a small creek called the "Gates," near the edge of pines, were camped a few lodges of Spokane Indians. This nation is scattered about in small detachments over its country at present, to avoid the smallpox, which is said to be raging at a fearful extent in some camps.

February 27.—This morning we awoke well steeped in snow and rain, for the elements had pelted us most pertinaciously with sleet all night. Everything was cold and shivering. Nevertheless, while at breakfast, two robins managed to poise themselves on the icy limb of a cotton-wood, and sang with as much equanimity as if they had passed a fine night of it. Riding was cold, and the way monotonous, and we were heartily glad to reach camp again.

The only wood of any kind to be found on this prairie are a few cotton-woods, willow, and moose-wood, which fringe the "Gates," (the stream on which we camped last night and to-night,) and a few other small streams. The "Gates," though nearly dry in the summer, is quite prolific in fish and clams. Near our camp there is a quantity of shells on the bank, where the Indians have had a clam-bake.

February 28.—An hour's ride brought us to the junction of the "Gates" creek with the Pieuse river, a petulant little stream, that was now in one of its froward spells. This was the crossing-place of the trail to Snake river; but there were no means at hand for constructing a raft, and rather than try the temperature of such a perverse torrent, we concluded to follow it on the same side to its junction with the Snake river. About five miles its course was nearly due west; it then made an abrupt turn to the south, and continued in the same general direction to its mouth. At the angle the stream fell in an unbroken sheet over an abrupt straight ledge into a deep basin about twenty feet below, from which, after recovering its shock, it pursued its course to the left with a more gentle flow. The fall bears a striking resemblance, except in size, to the "Great Fall" of the Missouri. The stream now elbowed its way between high, bold banks of trap formation. Sometimes a stone might be dropped from the top of the bank into the water a hundred and fifty or two hundred feet below, and again the banks fell back in serrated steps to the prairie-level. The whole appearance of the cañon looked as if it had been stamped with a big die, rather than worn by the water.

At the crossing of the Snake river, a band of twenty or thirty lodges of Pieuse Indians was camped. They lived in comfortable looking mat lodges, were rich in horses, and raised corn, wheat, and potatoes. They had a burying-ground fenced off near the river, in which were several graves. At the head of two of them were rude crosses, poles about ten feet long stuck in the ground, with cross-pieces near the top.

The Snake river is here about 250 yards wide, and very swift. The animals were relieved of their saddles and driven across, while we availed ourselves of three of the largest canoes brought us by the Indians, and crossed our equipments. The terms of ferriage with these Indians is anything one has a mind to give them, and with a few pounds of beef and a little tobacco they went off perfectly satisfied.

March 1.—The morning was cool and windy, and riding uncomfortable. After thirty-eight miles of rapid travelling, we camped on the Wallah-Wallah river. This stream, at camp, is narrow, deep, and rapid, and its banks are skirted with a narrow growth of cotton-wood, alder, and willow. The prairie between Snake river and the Wallah-Wallah is high-rolling, and sometimes hilly, without a tree, shrub, or rivulet. Its soil, however, is good, and supports very fair grass.

March 2.—We reached Wallah-Wallah early on the 2d, and partook of the hospitality of Mr. Pambrun, its governor, for the night.

The next morning, having procured a relay of fresh animals, we continued on down the left bank of the Columbia, and camped ten miles from the fort.

March 4.—For twenty miles below Wallah-Wallah the trail winds along under beetling banks, from whose inaccessible cliffs the bald eagle watches his prey below. The bluffs then fall back in a slope to the high inland prairie. The soil is sandy and barren, and almost the only vegetation that covers the surface, except in a few more favored spots, is scrubby wormwood. The river is wide, and well stocked with ducks and geese, which congregate in great numbers on its sandy points and bars.

At the end of about thirty-five miles we camped on the best point for grass that could be found, but it was still poor. Soon after, a canoe which was dropping leisurely down the river, with a load of whooping and singing Indians, approached the shore, and its variegated crew favored us with a visit. Being on their way to the Dalles, they were all dressed in their Sunday's best—in old clothes, cast off probably by emigrants, which were so patched with different colors that it was difficult to see of what color the original garment had been. One of them, proud of his exterior, and wishing to show that in addition to his fine appearance he was a man of "means," pulled out a small piece of buckskin, carefully unrolled it, and produced *two cents*, which, after shaking with great complacency, he as carefully rolled up again and put back. Another small party from a camp near by looked in upon us about sunset. One of this band brought a pack of cards rolled up in a greasy rag, and was very solicitous to get up a game.

Last night it rained till nearly morning, when it turned into sleet, and at sunrise discontinued altogether, though it remained damp and heavy this forenoon.

On the 5th we travelled about 30 miles. The country was more broken and rocky than yesterday, near the river, but the soil was about the same. On a shingle beach which we passed soon after noon, I picked up a few small pieces of agate, obsidian, onyx, and petrified wood.

March 6.—Camped on the "Des Chutes" river. The banks have been high and rugged on both sides, but the soil on the flats has been much better. On some of them, grass of this year's growth is several inches high and quite thick.

The "Des Chutes" river is about 12 miles from the Dalles, and after fording it on the morning of the 7th, it may be imagined that no time was lost till we jumped off our horses for the last time, and our feet again touched civilized soil.

Temperature, &c.

Date.	Temperature.			Remarks.
	At sunrise.	At 12 m.	At sunset.	
1854.	°	°	°	
Jan. 2	....	....	+55	High SW. winds, and thick, heavy clouds.
3	+20	+12	+ 6	Wind a few points east of north; morning, overcast; at sunset, snowing.
4	−12	−10	−16	Morning, wind NNW., and snowing; at noon, breaking away; at sunset, clear; wind west; slight breeze.
5	−11	0	+ 1	Sunrise, wind SSW. strong; at noon, same; sunset, S.
6	+20	+17	+29	At sunrise and noon, wind SW.
7	+30	+33	+32	Wind SW. all day.
8	+36	+51	+46	Wind SW. all day; nearly clear in morning, but overcast at night.
9	+39	+44	+38	At sunrise and noon, wind SW.
10	+16	+36	+28	Sunrise, clear; at noon and sunset, a slight breeze from SW.; at sunset, sky overcast.
11	+32	+32	+32	Wind from W. all day; at noon and sunset, stormy.
12	−16	*−21	−18	*The noon observation was taken on dividing ridge at 12 m.; and at sunset, wind NE.
13	−24	−19	−23	Stormy all day, and wind NE.
14	−25	−15	−16	Light winds from NE. all day; morning cloudy; afternoon clear.
15	−34	− 1	−18	Clear, and without wind.
16	−38	− 1	−21	Do. do.
17	− 8	+ 8	− 1	Cloudy all day; at noon, wind NE., and snowing; at sunset, clear.
18	−13	....	− 6	
19	−16	− 8	−14	Fair; no wind.
20	−23	− 2	− 6	At noon, wind SW.; snowing a little; at sunset, clear.
21	1	7	9	Sunrise, wind NE.; snowing; noon, wind SW.; at sunset, clear.
22	1	7	....	
30	....	42	39	Sunrise, cloudy.
31	55	52	42	Sunrise, wind SW.; noon, rainy; sunset, wind SW.: rainy.

Temperature, &c.—Continued.

Date.	Temperature.			Remarks.
	At sunrise.	At 12 m.	At sunset.	
1854.	°	°	°	
Feb. 1	28	25	25	Wind W., and cloudy all day.
2	13	34	26	Mostly clear.
3	13	39	39	Sunset, cloudy, with strong SW. wind.
4	36	42	39	Cloudy, and snowing a little till sunset.
5	15	42	30	Very few clouds.
6	26	34	35	At sunrise, wind SW., and overcast all day.
7	33	41	36	Cloudy all day.
8	33	45	37	Overcast all day; at noon, wind SW.; at sunset, NW.
9	34	42	37	Overcast all day.
10	30	39	35	Latter part of the day rainy.
11	33	35	30	
12	23	35	30	Cloudy, and snowing a little all day.
13	28	36	30	
14	15	28	26	Noon overcast, and snowing a little for the rest of the day.
15	22	26	25	Overcast, and breeze from the west all day.
16	+23	+37	+28	Wind NW. most of the day; cloudy all day.
17	+25	+33	+30	Morning cloudy, with NW. wind.
18	+26	+39	+32	Morning cloudy and snowy; rest of the day fine.
19	+15	+42	+28	Morning overcast; evening cloudy.
20	+26	+37	+34	Snowed till 3 o'clock; evening cloudy.
21	+29	+41	+31	Cloudy all day.
22	+24	+42	+38	Cloudy all day; at 3 o'clock NE. wind sprang up.
23	+33	+38	+34	Morning, snow falling; afternoon, fair.
24	+25	+51	+33	Clear and bright.
25	+33	+40	+35	Morning cloudy; 12 m. wind SW. and sleeting; sunset same.
26	+32	+42	+35	Wind SW. all day; a few clouds.
27	+35	+47	+41	Wind SW. all day; morning overcast; all day cloudy.
28	+31	+46	+45	Morning cloudy; rest of the day fair.
Mar. 1	+41	+45	+42	Wind SW. all day.
2	+33	+45	....	Cloudy, with showers all day.
3	....	+43	+41	
4	+34	+46	+40	Cloudy and heavy in the morning, but fair the rest of the day.
5	+35	+49	+46	Morning cloudy; evening fair, with SE. breeze.
6	+37	+54	+45	Fair, with breeze from W.

C. GROVER,
Lieutenant U. S. Army.

To Gov. I. I. Stevens.

LETTER OF GOVERNOR I. I. STEVENS TO THE SECRETARY OF WAR, TRANSMITTING REPORTS OF LIEUTENANT JOHN MULLAN, U. S. A.

Olympia, Washington Territory,
January 3, 1855.

Sir: I have the honor herewith to transmit the reports of Lieutenant John Mullan, giving the results of his explorations in the Rocky mountains, in pursuance of my instructions posting him in October, 1853, in the St. Mary's valley, made since his examination of the Little Blackfoot passes, in March, 1854, which was at the time made the subject of a report and included in the various reports submitted with my general railroad report of the 30th of June, 1854.

The reports are as follows:

1. Report dated Cantonment Stevens, Bitter Root Valley, May 8, 1854, of his examination of the country from the Bitter Root valley to the Flathead lake and the Kootenaie river.

2. Report of his subsequent operations, including his examination of a pass over the Cœur d'Alene mountains, which will furnish an excellent wagon road, and probably a practicable railroad line.

3. A general meteorological report.

I also include with these reports two maps of the country explored.

These reports I submit with great satisfaction, as they contribute materially to our knowledge of the country, and present Lieutenant Mullan as an officer of judgment and enterprise. In a special report of this date, I have urged that Lieutenant Mullan should be continued on duty in exploring the country, with which he is now so familiar.

I am, sir, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

REPORT OF LIEUTENANT JOHN MULLAN, U. S. A., OF HIS EXAMINATION OF THE COUNTRY FROM THE BITTER ROOT VALLEY TO THE FLATHEAD LAKE AND KOOTENAY RIVER.

CANTONMENT STEVENS, BITTER ROOT VALLEY,
Washington Territory, May 8, 1854.

SIR: Agreeably to your letter of instructions to continue the exploration of the country between the Rocky and Bitter Root ranges of mountains, extending as far north as the Flathead lake, and even the upper waters of Clark's fork of the Columbia, I have the honor to report that I started from the Bitter Root valley on the 14th of April, to make the said exploration, my working party consisting of Mr. Adams, assistant; Gabriel, my interpreter; two of my men, Gates and Sohon, and an Indian boy.

As it was impossible to secure a guide from among the Flathead Indians who knew anything of the country to the north, it became necessary to visit the Pend d'Oreilles' camp, in order to secure a man who could give me some information as to the character of that section. I intended, after making an examination of the Flathead lake, the character of the Clark's fork at the inlet and outlet, and its general character north of the lake, to cross the ridge of mountains to the west of Clark's fork, striking the Kootenay river, and examine the section of country watered by that stream and its tributaries which flow from the east and south.

My only knowledge of that region was based upon Mr. Tinkham's reconnaissance along the Flathead lake to the so-called Marias Pass; and this gave me but very little information, as I had merely a sketch of the Clark's fork and the lake, and no description whatever as to the character of the broad area from whence flow the many streams to each of these two large tributaries of the Columbia.

It is true, I had for reference a tracing compiled from information, and a map of our western territories as compiled by the Topographical Bureau in 1850, but I found these so essentially wrong in detail that I did much better without than with them. I anticipated much trouble from the high waters of the many streams I should be obliged to cross, but resolved to make the exploration at this time, or I might be compelled to defer it until late in the summer; and, as the latter part of this report will show you, we came near paying for it with our lives, for my whole party was near being drowned while rafting the Hell Gate river.

On account of the high water in the Bitter Root river, which was swimming deep, I followed down its right bank until reaching the Hell Gate river, on the right bank of which we camped the second night from Cantonment Stevens. We found the stream much swollen by the melting of the snow in the mountains, though we crossed it when going towards the north without much difficulty. My first camp was with Mr. Irwin and some Pend d'Oreilles, who being on their route to the emigrant road at Fort Hall, lost fifty head of horses, stolen on the 12th of April by the Blackfeet. Being thus robbed of everything, they were compelled to remain in camp until they could be befriended.

These Blackfeet had been in the mountains apparently several weeks, had built themselves a fort, and had killed two cows from the valley, the meat of which they had dried. They left in the fort seven pairs of snow-shoes and many trinkets.

Seventeen Flatheads and Pend d'Oreilles pursued across the mountains, through deep snow and timber, but succeeded not in overtaking them; and thus these hell-hounds made off with a large and valuable band of fat horses.

Hearing this, I sent an Indian back to my camp with instructions to have our animals guarded during the day and corralled at night, thus using every precaution in securing a large and valuable band of government animals, which are by no means safe from these well known and noted horse-thieves of the Rocky mountains.

We resumed our march on the morning of the 16th, in a heavy rain-storm; our trail for seven miles being over a rolling prairie, when we entered Conacan's defile. This is a defile in the mountains separating the Jocko river from the Hell Gate: it is so named from the fact that three Kanakas, bearing this name, were killed here some years ago by the Blackfeet. We found the road very rough and rocky, with much fallen timber along the trail. On the summit of this divide is a small prairie called the "Camash Prairie." It is here where the Pend d'Oreilles, at times, dig the camash root.

Gaining the base of the divide on the north, we struck the "Course des Femmes," a small stream that empties into the Jocko. It is so named from the fact that here formerly the Indian women ran races. It flows through a level and beautiful prairie, where we found the grass very rich and green. The camash grows here quite abundantly.

Travelling a few miles farther in this prairie we struck the Jocko, which we had to our right. This we found quite a large stream, being now swollen by the melting of the snow in the mountains. We crossed it five times during the day, it being fordable at each crossing. At a distance of thirty-six miles from the Hell Gate we struck the Clark's fork of the Columbia, encamping on its left bank a short distance above the mouth of the Jocko.

This stream we found very much swollen; we tried the ford during the evening, but found the water very deep, and, as it was necessary to go as far as Horse Plain before seeing an Indian who could guide us in a northern direction, we were compelled to build rafts to cross the river. So, setting the party at work after arriving in camp, we had at the river's edge by sunset timber sufficient for two rafts, so that early on the morning of the 17th we made our rafts and crossed everything in safety to the opposite bank. The river at this point is two hundred and fifty yards wide, and in the channel we could not find bottom, having tried it with poles fifteen feet long. Thence resuming our march down the right bank of the Clark's fork, we found the trail leading over a somewhat rough and difficult road. It lay principally along the side-hill, where had broken off numberless rocks and fragments of rock, affording us a very difficult road; a much better road we found on the opposite bank of the river, as there is a low level beach extending to the point of the river where it enters a steep mountain cañon. Where the trail leaves the river it is fordable in low water, and during high water it could be rafted. The trail on the right bank bends to the northwest, and does not strike the river again till it reaches Horse Plain. Travelling a distance of twenty miles, we passed in the Camash prairie Michelle Ogden, the gentleman in charge of Fort Conna, on the Flathead river, when we encamped for the night. Finding here some Indians, I secured one who could guide me to the forks of Clark's fork. As I was informed here that it was impossible to reach the Kootenay river at this season on account of the great depth of the snow in the mountains, I concluded to go as far as the forks of the river, and then strike to the west and reach Camash prairie by a different route, unless I could find a guide at the Pend d'Oreille camp who would guaranty to guide me through to the Kootenay river. The Camash prairie referred to is nearly a circular prairie in the mountains, and perfectly level. The grass this season growing in it is exceedingly green and abundant. It is sheltered on every side by high hills and mountains, the soil is very fertile, and there is no better spot in the mountains either for agricultural or grazing purposes than this beautiful valley. It is true that during some seasons the snow is found to be very deep, but it is not of long duration; during the spring and summer seasons it is a great resort for the Pend d'Oreilles, for here they find camash and bitter root in abundance, their principal roots for food.

Finding excellent grass, we remained in camp on the 18th. We were visited by several showers of rain during the day. Whilst here I was compelled to remark the generosity and kindness of the Indians and half-breeds among whom we had pitched our camp. Having here a number of cows, they brought to us milk in such abundance that our lodge might have been taken for a dairy, more than the shelter of a small party of mountain travellers. Their presents of excellent salt and fresh buffalo-tongues, the epicurean dish of the plains or mountains, were also duly appreciated. On arriving at their camp the evening before, the women of the camp turned out "en masse," pitched our lodge, packed our wood, built our fire, and would probably have extended the limit of their kindness much farther had we not requested them to desist.

April 19.—I intended this morning to visit the camp of the Pend d'Oreilles, who were then on the Clark's fork of the Columbia. At the distance of five miles in an easterly direction we gained the summit of a low ridge of hills, or mountains, from which we had an excellent view of the valley of the Clark's fork. The river in front of us flowed through high clay banks, while the country to the east for fifteen or twenty miles was somewhat broken with several small streams winding their way from the mountains, which here formed a very high snow-covered ridge. The mountains were very rough and rugged, many peaks being jagged, while others assumed a dome-shape and towered their sun-capped summits high above the level of the valley. The country to our right and left appeared to be one immense bed of rugged hills, their tops being well timbered with the pine. Gaining the base of this ridge, we struck a small but swift and deep stream called the Hot Spring creek, which takes its rise from a range of mountains to the north. We followed along the right bank of this stream to its mouth, where it empties into the Clark's fork; it is now about twenty yards wide, and in places very deep. Having made a distance of thirteen miles, we encamped at its mouth on the Clark's fork. We met on the trail to-day two Indians from the Pend d'Oreilles' camp, who had been sent by their chief, on hearing of our being in their country, to ask us to visit his camp. This we had intended to do without a formal invitation, as we desired to gain information from them as to the character of the country to the north at this season, and to ascertain from them, and some Kootenay Indians whom we heard were camped with them, as to the snows in the mountains and the character of the country generally to the head-waters of Clark's fork and to the Kootenay river. We found encamped at the mouth of the Hot Spring creek, Alexander, the principal chief of the Pend d'Oreilles, with forty-seven lodges. We also found encamped higher up on the creek some twelve or fifteen lodges of Kootenays, Spokanes, and Pend d'Oreilles.

We had a talk with these Indians, who appeared very glad to see us; and an old Yakima chief named Ow-hi, the great friend of the white men, being in this camp with a broken leg, sent for us, and requested us to come and see him. We visited him, and found him to be a noble and generous Indian. He is a large man, and has an open and benevolent face. He has letters from several whites, and having been among and having seen much of them, he is now their firm and stanch friend, and deserves humane and kind treatment at the hands of every white man with whom he should meet. We ascertained in the camp of the Pend d'Oreilles that the country north towards the Kootenay river was not so bad as had been represented to us the day before; but, on the contrary, we learned there was no snow in the mountains, and the greatest difficulty we should have before reaching the Kootenay river would be the fallen timber in places and high water, both of which I did not deem insuperable obstacles to keep us back; so, securing an Indian who knew something of the country, we resumed our march early on the next day, travelling up and along the right bank of the Clark's fork. The river we found to-day very tortuous, making numerous and large bends. It flowed mostly through high clay banks, the borders on either side being much cut up by numerous but small coulées, which gave the whole section the appearance of the country along the upper portion of the Missouri. The soil is principally a light yellow clay, so that there is little difference in appearance between this district along the Clark's fork and the Mauvaises Terres of the Missouri. The river we found to be two hundred yards wide, and swift and deep. Its banks are sparsely timbered with the pine and cedar; some few trees of the cotton-wood and quaking asp were to be seen along its banks; but the principal trees were the pine and red cedar, both being of a small growth. Gaining a high point of view on our march, we could trace the windings of the river for many miles, by the long line of timber skirting its borders. We had an excellent view of the country in every direction save to the east, our view here being limited by the high range of snow-clad mountains mentioned yesterday. This range has a direction nearly north and south, and is exceedingly high. It runs along the eastern border of the lake its whole length, which, during high water, forms its left bank or shore; it thence continues up the Clark's fork to its head. At about fifty miles north of the lake is a spur of equal height bending to the west, and extending to the Kootenay river. The country to the north from whence we viewed it appeared to be one immense bed of mountains and rugged hills. The country south of the Flathead lake, and between the range of mountains referred to and the Clark's fork, is much broken in appearance from a point of view twenty miles distant. Through this section flow two small streams, the more northern of the two being called the Crow river, and the other the Birch—so named from the great abundance of that timber found on its borders. Travelling a distance of twenty-three and a half miles we reached the southern end of the lake, at the point where the Clark's fork leaves it; here we encamped for the night. The river at the outlet is two hundred and fifty yards wide; the current is not rapid, but at a distance of half a mile begins a series of rapids and falls that extend down the river for eight miles. There is one fall in this distance of fifteen feet. The lake at its southern extremity is about four miles wide at this season, and at a point six or eight miles above makes three beautiful islands, which obstructed our view to the north. Its southern border is sparsely wooded with the pine; the country to the west along its southern and western border being high-rolling prairie.

We found at the lake four lodges of the Pend d'Oreilles, who have been here some weeks fishing; they presented us, on arriving at their camp, with some fine fresh and dried salmon-trout. This lake, and also the Clark's fork here, abounds in excellent fish, the salmon-trout being the most abundant. These latter are caught from the lake, often measuring three feet long. It forms one of the chief articles of food for the Pend d'Oreilles at this season. During the winter they often camp here when the lake is frozen over, when, cutting holes in the ice, they secure an abundance of these most excellent fish. While here, during the night we were aroused by a noise from the river, when, going to see whence it came, we found three men swimming the Clark's fork; they had been fishing on the opposite bank, and, having secured a large number, they were returning to their homes. The night was somewhat cold, yet such is the hardiness of these men that they think nothing of undergoing fatigue of this character. On their arrival at our camp they presented us with a number of these so dearly earned but excellent fish. We were visited during the evening and night by several very heavy showers of rain.

April 21.—We travelled to-day along the western border of the lake. At a distance of two miles from our camp, we left the lake about two miles to the right, as the bluffs here came to the water's edge, and there is a trail only during low water. Here we entered a fine forest, through which we travelled for five miles, when we again struck the lake. While travelling through this timber we found a small but beautiful lake, called the Turtle lake. It is about half a mile long, and five hundred yards wide. The pine growing in this thicket is high and straight.

Striking the lake a second time, we had an excellent view, although much limited on account of the hazy and cloudy weather. Several large and beautiful islands lay near the middle of the lake, all covered with an excellent growth of pine; many of these islands are several miles long. On one of these, called the "Wild Horse" island, is a band of wild horses that belong to a Pend d'Oreille Indian. Some years ago the father of this man had horses stolen from him by the Blackfeet. In retaliation he stole a number from the Blackfeet, and put them on this island, all of which he intended for the benefit of his children. There is now a band of sixty or seventy horses, and only a few days ago they took off a band of forty-five. The lake makes many bends; at its greatest width I estimated it to be eight miles. Travelling a distance of fifteen miles, we reached a small creek emptying into the lake, and called the "Eclehu." Here we found encamped four lodges of Pend d'Oreilles; and as the grass was excellent, I concluded to camp, and give our animals a hearty repast, as it was possible that we should have a rugged and difficult country to the north, which would require our animals to be in good condition to withstand the fatigues of the journey. The Indians here camped, as those we met on yesterday, were engaged in fishing for the salmon-trout. They had traps set, and had been very successful. The weather to-day has been exceedingly gloomy and disagreeable, raining during the greater portion of the day, and at times exceedingly heavy. I found the soil of the country passed over to-day exceedingly fertile, and it is well adapted to grazing. The lake, as on yesterday, we found skirted with small pine and cedar; all the hills and mountains, however, bordering the lake, are well timbered with the pine. We were told by the guide that one mile from the "Eclehu" is a small but beautiful lake; it was only a short distance from our trail, but was hid from view by a low ridge of hills.

April 22.—We were visited last night by a cold snow-storm, which continued unabated until nearly 11 a. m., when it cleared off, and became bright sunshine for a short time. I had concluded to remain in camp during the day; but thinking it to result in greater advantage to the party to progress on our journey, we started at 11.30 a. m., along the western border of the Flathead lake. At 12 m. it commenced snowing again, and continued throughout the day, with great force; but the ground being warm, it melted as fast as it fell. Our trail to-day lay through an immense pine forest, in the greater part of which the light of day is ever excluded. We found the travelling more difficult than on any day out; the great numbers of fallen logs and large trees impeded our progress, compelling us many times to go around them for many yards from the trail. This pine forest extends to within a few feet of the lake. The pine is very excellent, growing high and straight, and very thick.

When the day shall arrive when civilization and the enterprise of the whites shall have frequented this region, this immense forest, bordering the lake, will prove of immense value to Washington Territory, and yield an abundant revenue to the industrious hand. The lake, along our whole course to-day, has a width of nearly five miles, being still bordered on the east by a high range of snow capped-mountains. We crossed three small brooks emptying into the lake, in one of which we found a fish weir, set by the Indians, for catching the salmon-trout. Towards evening, gaining a high point of view on the western border of the lake, we had an excellent prospect of the country to the east; we could trace the windings of a large stream flowing through two high snow-covered ranges of mountains, and emptying into the lake about three miles from the point where the Clark's fork enters it. This stream was represented by the Indians to be nearly as large as the Clark's fork. This latter stream enters the lake at the northeast end; I could, with my glass, trace its windings for some miles above the mouth of the inlet. About two miles above this mouth is the mouth of a small stream, called the Swan river, that flows from the east. We saw many geese and ducks, to-day, in the lake; but, besides a single grouse, our fare consisted of dried buffalo-meat. Travelling a distance of eighteen miles, we encamped at the north end of the lake. It was at the edge of a pine thicket; but as this was the last place that we would find grass for our animals for many miles, we encamped here, though at the risk of losing them in woods. I have remarked, that on this lake we have found the weather much more cool than before reaching it. We made three camps, and on each night we found the weather very cold. Our camping-ground of this night was represented to me by the Indians as a great resort for their tribe and the half-breeds of the country some years ago, as in the mountains bordering the lake immense numbers of deer and elk were found, while the lake afforded its usual abundance of excellent fish, but now little if any game is found throughout this whole region; yet this beautiful lake has lost none of its pristine character in yielding to the fisherman a rich and abundant harvest at all seasons. May it not be, in years to come, when this hitherto neglected region shall become a thickly settled district, that the lumber and the fisheries of this beautiful lake of the mountains shall constitute one of the chief articles of trade from this region, and return to the coffers of the future State of Washington a handsome and valuable revenue?

Cannot navigation be extended from the Pacific to the very base of the Rocky mountains? What is there to prevent it? Are there insuperable obstacles in the way? No; in my humble judgment, I think not. Let but the enterprise and the ingenuity of the Yankee nation once be extended to this now secluded and neglected region, and soon will be seen steamers ploughing the beautiful waters of the Columbia from its mouth to the base of the mountains. The river always affords, except during three months of the year, an abundance of water for navigation; the borders of the stream and its lakes afford a sufficiency of fuel; and all it now needs is, to have the Cascades, the Dalles, and the few falls above the mouth of the Lewis's fork, removed, to complete the water communication from the Pacific to the Rocky mountains.

April 23.—Continuing for a short distance this morning through the pine forest passed through yesterday, we emerged into a broad, open, level, and beautiful prairie, that extends from the north end of Flathead lake for a distance of thirty or forty miles to the north and twenty miles to the west. The soil here is very excellent, and the great number of sloughs, small lakes, and ponds, afford an abundance of small game. There are two beautiful streams flowing through this prairie bottom, both of which we crossed during the morning. The first is called the Cotton-wood creek, from the great abundance of that timber found on its borders; and the second the Maple river, from the reported abundance of this timber found on its banks, although I saw none on the river the whole distance travelled. Gaining this prairie, we could trace the mountains for many miles. We observed that the range referred to several times as running along the eastern border of the Flathead lake, continues its general direction of northwest and southeast; but at a distance of forty or fifty miles from the north end of the lake, a spur of this range, similar in all respects to the main range, bends more to the west. This spur, as the main range, was covered with snow to midway of its height. The mountains here are all well wooded with pine; their summits are a combination of jagged and serrated peaks, with many dome-shaped peaks, all covered with snow.

The Cotton-wood creek we found to be ten yards wide, with a gentle current; water in the ford two feet deep, and good banks on either side. The Maple river I found to be the swiftest stream that I have ever crossed in the mountains. It flows, at the ford, over a rocky bed. The water we found near three feet deep, and, with its impetuous current, we could with difficulty ford it. Most of our packs were submerged, and everything wet in the crossing. Before crossing this stream, we struck again the Clark's fork, along which we travelled for a mile. Here the stream is one hundred and fifty yards wide, flowing with a sluggish current through high clay banks, and is well wooded on the left bank with the cotton-wood and pine, principally the former. The water is not clear, but is colored yellow by the waters of the Maple river, which are very turbid at this season. We followed up the Maple river on its left bank for a distance of ten miles, our trail lying partially over the level prairie before described, and partially through a dense pine forest. The timber here is very high and straight, with much underbrush. The grass we found here to be very sparse and poor. Gaining a small prairie, along the southern edge of which the Maple river flowed, we encamped, having travelled a distance of twenty-two miles. We found here poor grass; but as the guide told us it was the best we should find for many miles, our animals had to fare upon very indifferent repast. The day has been bright, warm, and pleasant.

April 24.—Resuming our march this morning at 8 a. m., our trail continued the whole day through one immense dense forest. In many places we found no trail visible, and with the exceedingly thick undergrowth, large and numerous fallen logs, and the many sloughs and mud-holes, rendered our travelling anything but enviable. Our trail lay on the left bank of the Maple river, which, about fifteen miles from our camp of last night, we found to make three large and beautiful lakes—the water in two being exceedingly blue and deep; the third we found frozen over. We passed over small banks of snow to-day, but not in sufficient quantities to impede our progress; the greatest difficulty that we found was to travel without bruising or breaking every limb, from the standing and fallen timber. Truly, I considered this one of the worst roads, if not *the* worst, ever travelled by whites or Indians, and still it is the main trail of travel for the Kootenays from their country to that of the Pend d'Oreilles. Four lodges of these Indians we met in the dense forest to day. They were both glad and astonished to see us, and were anxious to know our point of destination in this lonely and deserted region. We observed, as soon as we met these poor and miserable creatures, that they had been visited by the Jesuit priests, for on shaking hands with them each one made the sign of the cross. These families were travelling to the country of the Pend d'Oreilles.

The lower Kootenay Indians are represented—and from what I have seen I can corroborate the same—as being an exceedingly poor, improvident, and miserable tribe of Indians. They are poor in horses, have few or no skin lodges, make but little meat for their sustenance, and, in a word, live a miserable existence. We found them poorly and thinly clad, travelling with few horses, each horse carrying two and sometimes three persons; their lodges were made of mats formed of a tall rush found growing in the marshes. Their chief article of food when travelling is roots, and fish when at home. Their language is similar to that of the Blackfeet Indians east of the mountains.

Travelling a few miles farther, we met two lodges who had been camped in the woods two days. We saw only the women and children; the men were searching for lost horses. So very scarce is the grass on this route, and so difficult the road, that often the Indians are compelled to camp without a blade of grass for their animals; we, however, were very fortunate, at night finding a low, marshy bottom, which afforded our animals a sufficient, but at the same time a scanty fare.

April 25.—Our course for the greater portion of this day lay again through an immense, dense pine forest, over fallen timber, through thick underbrush, and innumerable bogs, mud-holes, and sloughs. The soil, since leaving the large prairie at the north end of the Flathead lake, we found very poor and barren, as the country is covered with an immense pine forest, from which the light of day is nearly ever excluded; and the soil being formed of pine burrs, dead timber, and in many places fragments of rocks, it precludes the possibility of anything growing, even a scanty fare of grass for the animals that travel over its uninviting surface.

At 12 m. we gained the summit of the divide separating the waters of the Clark's fork from those of the Kootenay river; at this point the Maple river takes its rise. On the summit we met a Kootenay chief with two lodges of his tribe, on their way to the country of the Pend d'Oreilles, and having with us a horse much wearied we turned it over to him, to be delivered to Mr. Ogden during the summer, knowing full well that he would take good care of it, and no other alternative was remaining but to abandon it on the road. The timber is not so dense on the north as on the south side of the divide: it being much larger, was more scattered, and with much less undergrowth. A short distance from the summit we crossed a small but rapid stream whose waters flow into the Kootenay river.

We crossed during the afternoon three tributaries of this branch, upon the last of which we encamped. We were now seven miles from the Kootenay river, having entered a different and by far better region than we had been travelling through for some days. The country had now become a high-rolling prairie opening, which extended along the tributary of the Kootenay river referred to, for fifteen or twenty miles in length, and the same in width; the grass here is exceedingly rich and luxuriant. I determined to halt and rest a day, to recruit the animals, which had now become very much jaded by their long and fatiguing march; and on the morning of the next day (April 26th) leaving my camp, I went with my guide and interpreter to the Kootenay river. At the point where we struck the river we found it to be four hundred yards wide, and flowing through low banks, with a gentle current.

The country on its left bank forms an immense, low prairie bottom, in which the grass grows luxuriantly; this extends to the base of the mountains on the east. The country on the right bank, at the same place, is formed of a series of pine-clad hills that extend to the mountains of the north, which latter are very high, their snow-capped summits seeming lost in the clouds. The river runs for many miles from the northeast, through two high ranges of snow-covered mountains, many of whose peaks are covered with snow through every season.

The soil along the Kootenay river is very fertile, and at the point where we struck it was carpeted by a beautiful green sward, upon which was growing an exceedingly great number of beautifully-colored and varied plants. Here I made a rich botanical collection, a description of which, from my limited knowledge of that science, does not here find a place, but is left for more able hands. This place is a great resort for the Kootenay Indians when not hunting in the mountains, as here is found at every season an abundance of excellent and nutritious grass; the winters are represented as being mild, and the waters of the Kootenaie river afford them, at all seasons, a bountiful supply of the salmon-trout. So they have but to enjoy the many blessings and favors fortune has placed at their disposal, and live in their sluggish and miserable independence from year to year.

The region of country bordering the Kootenay river for many miles on the south is totally unlike that bordering the Clark's fork; but few prairies are found, and there is but little else than one immense pine thicket, from the greater portion of which the light of day is ever excluded, and in which the sound of the axe of the white man has never yet been heard. Lead and coal are both said to be found on the banks of the Kootenay, although I saw no traces of either where we struck the stream.

Having now accomplished one of the objects for which we started, I determined to strike the Clark's fork to the south, but by a different route from that followed to the Kootenay river, which should lie more to the west, turning the immense bed of mountains bordering the Flathead lake on the west, and thus solve the problem of the character of the large belt of country between the Kootenaie river and Clark's fork, from which flows no large tributary to either of these two streams; so, resuming our march on the morning of the 27th of April, we continued for a distance of ten miles on the same trail which we had followed going to the Kootenay river. This brought us to the crossing of the "Tobacco creek;" at this point our homeward trail bent more to the south of east. At the distance of a mile from the Tobacco creek we struck a fork of the main branch, which we found swimming deep, very rapid, and about twenty yards wide. Having unpacked everything, one of our Indians, stripping himself, packed everything on his back, swimming the river on horseback. By felling trees we made a bridge, and crossed over in safety. Two miles distant, our trail leading through an open pine forest, we reached a prairie bottom, where we encamped for the night, having travelled a distance of only thirteen miles; but we were compelled to camp here, as it was the only grazing ground we should find for many miles.

The weather to-day has been mild and pleasant, although during last night we had a heavy rain. On leaving camp this morning we were visited by a large number of Kootenay Indians, who brought with them roots and skins to trade. They represented that they were in a miserable condition; no meat, or ammunition to procure any. We gave them a little powder and ball, at which they appeared exceedingly glad.

April 28.—We continued this morning our march for the Bitter Root valley, travelling all day through an immense and dense pine forest. At a distance of a mile from the camp of last night we crossed the western fork of Tobacco creek, which we were compelled to swim. Our road to-day was indescribably horrid—fallen timber piled up for many feet, over which our animals had to jump, innumerable mud-holes and quagmires, rocks, under-brush—in a word, everything to make our road miserable in the extreme, and endangering the lives of both men and animals. Grass we found none, compelling us to travel a distance of forty miles; and even then we found a very scanty fare for our animals, encamping at the edge of a pine thicket. We crossed to-day a dividing ridge, which separates the waters of two branches of the Kootenay river. We found a stream running to the southeast; which, towards our night's camp, bent more to the west, and which, our guides stated, emptied into the Kootenay river. At the head of this stream we found a very magnificent fall of sixty feet. The water flows through two high vertical walls of rock, with an impetuous current dashing over rocks and precipices in one immense sheet of foam, the noise of which we heard many miles distant. The scenery here is truly grand: the black, vertical walls extending for a long distance on the west, and several hundred feet high, their tops covered with a dense growth of pine; while on the east, rocks and stones in wild confusion lay piled up for many hundred feet, with this roaring and magnificent cataract occupying the intervening space, dashing with a headlong current until it joins the main branch, flowing gently through a low and narrow valley. It serves to give life to this otherwise dreary and dismal region, and partially repays the traveller for many of the vexatious annoyances that he is compelled to suffer while journeying through this most uninviting country. We found the soil along the whole route to-day sterile in the extreme; no grass on the whole route, and nothing growing in this immense pine desert, save the small running vine called by the Flathead Indians "scolesay," which they smoke, mixed with tobacco. The mountains on each side of us were high and covered with a dense growth of pine, while on the summits of many of the higher peaks, snow was still to be seen.

April 29.—The whole of this day's march lay over a succession of pine-clad mountain ridges, with small patches of prairie intervening. The trail, leading through the timber, afforded a bad road, although not as difficult as we have had for many days past.

In nearly all of these prairies are beautiful lakes, most of them without outlets. The mountains forming belts or girdles, necessitate the case of the meltings of their snows being received in these reservoirs at their base. Some of these basins are two or three miles long, and a mile or more wide. At one of these lakes we found a Kootenay Indian fishing, who, on arriving at his camp, presented us with a bag of most excellent fish, resembling very much the ordinary "sucker" of the Eastern States. In one of these prairies we also found encamped a Kootenay Indian, who, on our arriving at his camp at noon, insisted upon our halting and tarrying with him until he should prepare dinner for us. We were much pleased with his noble generosity. We had but little to recompense with, but I gave him in return a few loads of ammunition and my leggins, at which he was much pleased.

To-day we were compelled to travel a distance of thirty-six miles to reach good grass and water for our animals. Camped on the Hot Spring creek, near its head.

April 30.—To-day we left the woods and reached once more the rolling prairie, which even our animals appreciated, for they had suffered much while travelling through this immense pine forest, with poor grass and necessarily long and fatiguing marches. The greater portion of our journey lay to the left of the Hot Spring creek, which we crossed twice by a ford over a beautifully-rolling prairie country. A few miles from our camp of last night the Hot Spring creek enters a deep mountain and rocky cañon, compelling us to keep along the edges of the mountain's summit. Gaining the top of one of these prairie ridges, we had an excellent view of the country in every direction. To the south of us lay a low rolling prairie, limited by the ridges of hills bounding the Camash prairie to the east and northeast; to our right and left lay immense beds of pine-clad mountains. Travelling a distance of thirty-two miles, we reached the Camash prairie, passing on the road the camp of the Kootenay and Pend d'Oreille Indians, the latter of whom were encamped on the northern edge of the prairie. We found still camped here Mr. Ogden, who had awaited our return from the Kootenay river, and, very fortunately for us, he had, a few days previous to our arrival, received a supply of goods and provisions from Fort Vancouver, for we arrived at his camp without an iota of provisions. He willingly supplied us with a sufficiency to last us to the Bitter Root valley. We had here the luxury of a cup of coffee and a piece of bread, which having been without for many weeks, none could appreciate more than ourselves. Our animals being much jaded, we remained here a day to rest and recruit, where we found the grass green and abundant, and on the following day, (May 2,) securing the services of an Indian boatman to ferry us across the Clark's fork, we camped on its right bank, being unable to cross on account of the high wind. Early on the morning of the 3d of May we crossed everything in safety to the opposite bank. Our boat was a bark canoe, such as is used by the Pend d'Oreilles of the lake—light, but exceeding fragile. The river here is three hundred yards wide, flowing with a very gentle current. Thence travelling up the left bank of the river, for a distance of twelve miles, we turned more to the north, up the left bank of the Jocko river, crossing the Course des Femmes creek at its mouth, where we encamped for the night. We were favored to-day with mild and beautiful weather, which, together with the bright green grass, the blooming and budding of the trees, and the many beautiful and varied flowers that lined our pathway, rendered the day truly worthy of the month of May.

May 4.—Resuming our march this morning at an early hour, we reached the Hell Gate river at 1 p. m., which we found much swollen, deep, and very rapid. It here became necessary to build rafts, and setting the party at work, in three hours we made two rafts, and had everything ready for crossing. Gabriel, with one of the men and an Indian woman and her children, who had accompanied us from the Camash prairie, were on one raft, Mr. Adams, myself, and my remaining man being on the other. There was a point of land projecting from the opposite shore which it was our intention to strike, if possible; yet so impetuous was the current, that we moved in the channel with a headlong velocity, landing about a quarter of a mile down on the same side from which we started. Here so great was the current, that it was impossible to stop the raft, but we were thrown with frightful force against rocks, fallen trees, bushes, islands, in fact everything that formed an obstruction in the stream. Half a mile from our point of starting the current divided into two channels, carrying us to the opposite shore; here we were brought against a large fallen tree, the limbs of which we seized to stop the raft; but so strong was the current that we could not stem it for a moment, but moved with an awful swiftness down the stream. In our attempt to hold on by the limbs of the tree, I was knocked overboard, compelling me to swim with my clothes; I succeeded in reaching the raft, with the aid of one of my men, who dragged me out of the water. At this place we lost our poles, and were thus left to the chances of fortune. We then stripped to facilitate our swimming, and on nearing a rocky island each man, with a line that had been made fast to the raft, sprang overboard, as the last resort to save ourselves and the raft; here, by dint of perseverance and hard labor, we succeeded in holding it, allowing it to drift gradually against some fallen timber that lay at the end of the island. To the left of this rocky island lay another formed of fallen timber, but between the raft and the latter island lay a broad gulf of water, flowing with a most impetuous current; here we had sufficient time to build a log bridge, and throw everything from the raft to the island. We succeeded in saving the greater portion of our property; but just as the last bale was removed from the raft, already two feet under water, the water dashed over it, and in a few minutes it was broken to pieces and carried down this much dreaded river. Gabriel had been more successful, but had been compelled to swim with a cord three times, and with the aid of a horse, before he succeeded in landing in safety. And here I am compelled to bear testimony to the great energy, courage, and activity displayed by Mr. Adams on an occasion when our whole party came near being drowned: already fatigued by swimming, wading, and walking over rocks and stones, he threw everything from our raft to the island. Here we were, then, on a desolate island, naked, with a broad stream still between us and our shore of destination, and two miles from the point whence we started. We fired our pistols to let the remainder of the party know that we were still alive, who having already become alarmed for our safety, had ridden many miles down the stream in quest of us, but could not find us. Here Mr. Adams swam the stream, and, naked and barefooted as he was, made his way through bushes, briars, and fallen timber to our camp, a mile distant. In two hours, with the aid of horses, we were relieved from our most unenviable situation, but succeeded in having everything that was saved thoroughly wet. We were rejoiced at finding the whole party thus saved from an untimely end, and with one accord were willing to remember the crossing of the Hell Gate river.

Early on the morning of the fifth of May we resumed our march for the Cantonment, where we arrived during the evening, thus completing a short but eventful trip.

Taking now a retrospective view of the country travelled over towards the north, from the Flathead lake, we see that, with but few spots, the country is an immense, dense pine forest, soil exceedingly poor; nothing growing, save a small running vine called "scole-say." This characterizes the country to the summit of the ridge of mountains dividing the waters of the Clark's fork from those of the Kootenay river. Here the character of the Kootenay is materially changed; the timber that is found being much larger, consequently is more scattered, and the section immediately bordering the river being a rolling prairie, soil fertile, and an abundance of rich and nutritious grass being found.

Returning from the Kootenay river by a more western route, our road lay over a succession of mountain chains, which formed belts, or girdles, with small patches of prairie intervening. Being by nature thus formed, there is no possibility of any large tributary to either the Kootenay river or the Clark's fork flowing from them; but, on the contrary, the waters from the numerous springs, and the melting of the snows, are all received in small lakes at their bases. The soil in these prairies is very excellent, and they alone afford sufficient grass for the animals that travel over this secluded and little frequented region. These lakes abound in fish, and large flocks of water-fowl of every kind are here found. In the mountains are found game, and many roots, upon which the Indians subsist, so that this section has some redeeming characteristics, nevertheless. The mountains are all pine-clad, and many of the higher peaks are covered with snow throughout every season. Supposing for a moment that there existed a practicable pass through the mountains to the east of Clark's fork, the natural formation here found would preclude the possibility of a road to the Pacific; for, from the Clark's fork north of the Flathead lake, as far as I examined westward, the country is formed of one immense belt of mountains extending many miles in either direction, compelling a detour to be made along the Clark's fork. A detour from the route along the high table-land north of the Missouri is, therefore, inevitable; but the section already examined to the east of the main chain of the Rocky mountains is by far more feasible, by far more practicable, than that to the west of the mountains along the Clark's fork. This is only on the supposition that a practicable route exists across the range of mountains to the east of Clark's fork; but this chain having already been examined by one of the civil engineers of the expedition, and pronounced impracticable, loses all of its worth.

Having now examined the mountains from the 43d to the 49th parallel of latitude, extending from Fort Hall to our northern boundary, I can most unhesitatingly affirm, that the Hell Gate defile is the only one in this section that leads to the passes in the main chain of the mountains that are practicable either for a railroad or wagon route. This defile leads to six passes in the mountains; four of which have already been examined by your parties, and the remaining two yet remain to be examined—one with a view to shorten a route already known to be practicable, and the second the solving of a new problem of a route the eastern portions of which must necessarily lie more to the south than that already known to exist, from the head of steam navigation on the Mississippi to this defile. The connecting links to either one of these chains, westward, must, therefore, either be along the Clark's fork, from its first great northern bend, or through the Cœur d'Alene range of mountains.

Accompanying this you will find a map of the country travelled over, and sketches characteristic of the routes.

Truly, your obedient servant,
J. MULLAN,
Lieutenant U. S. Army.

Governor I. I. STEVENS,
In Charge of N. P. Railroad Exploration and Survey.

REPORT OF LIEUT. JOHN MULLAN, U. S. A., OF HIS EXPLORATION FROM CANTONMENT STEVENS TO FORT DALLES, THROUGH THE PASSES AND LATERAL VALLEYS OF THE ROCKY MOUNTAINS, INCLUDING A PASS OVER THE CŒUR D'ALENE MOUNTAINS.

FORT VANCOUVER, *November* 12, 1854.

SIR: In conformity to your letter of instructions of October 4, 1853, directing me to continue the exploration of the passes and lateral valleys of the Rocky mountains, gaining information as to the practicability of the same for railroad and wagon routes, and making a topographical map of the country traversed, and your later communication, dated at Washington city, June 2, 1854, withdrawing my party from the mountains, with instructions to follow the best practicable route to the Pacific, or the route explored by Mr. Adams, under my directions, I have the honor to report that I left Cantonment Stevens on the 19th of September last, for the fulfilment of the above instructions.

Your instructions of 2d June were received on the 23d of August; but in order to arrange my accounts of property, and carry out the views embodied in your letter, I was compelled to await the arrival of the party of James Doty, Esq., then under orders for the Pacific from the falls of the Missouri. By this means we were enabled to consult as to the routes to be followed westward, the plan of operation of each, and thus fully carry out your views for the interest of the survey.

On the receipt of your communication, I despatched an express across the mountains to carry to Mr. Doty his letters and instructions.

Mr. Adams, my assistant, having been assigned to duty as special Indian agent in the Bitter Root district, was absent by my order at the receipt of your letters, but arrived at the post on the 10th of September. To him I turned over certain animals and property that he needed for his purposes in the mountains. Mr. Burr, who had been associated with me for more than a year in meteorology, remained with Mr. Adams.

Our preparations having been completed by the morning of the 19th of September, we took our departure from the Cantonment where had been our winter home for twelve months; and I must say that, though the reflection that we were soon to mingle with our friends on the Pacific was pleasant and refreshing, still we parted with our late home with feelings of true and heartfelt regret. Our comforts had been few and rude, it is true, but sufficiently great to endear us to a place and a people that we shall not soon forget.

As you have already been informed in a former communication, Mr. Adams was instructed by me to examine and report upon a route across the Bitter Root mountains represented by an Iroquois Indian to be an excellent and practicable road for wagon trains, and which he was willing to point out. He was further instructed, that should the route, upon examination, prove to be such as it had been represented, he should with a party of nine men remove all obstructions, so far as his force would allow him, and cross the mountains to the Cœur d'Alene mission, where he should await further instructions. Early in March last he started to make the reconnaissance, taking with him as guide the Iroquois Indian referred to. I should here state that, at the same time, I left the Bitter Root valley to examine a pass across the mountains to Fort

Benton, upon which examination I reported to you in April last. On my return to the valley I learned from Mr. Adams that the route, as then examined, was covered with snow to such a depth, that he found it impracticable to travel with horses, and was compelled to return; but he reported that, so far as he examined the route, no obstructions existed to the passage of wagon trains, and that it offered no difficulty whatever for a railroad route. On my return from Fort Benton I had organized my party for an exploration to the north as far as the Kootenay river, of which, when completed, I intended to make, myself, the exploration intrusted to Mr. Adams. I returned from my trip to the Kootenay river on the 5th of May, and on the 21st of same month started to make the examination across the Bitter Root range by the pass described by the Iroquois. Owing, however, to the high water in the month of May, along the route I proposed to examine, I was not enabled to travel directly across the mountains, but taking advantage of a trip of Father Hocken, of the Jesuit mission, in the Pend d'Oreille country, I thought it better to descend by the Clark's fork of the Columbia, and to examine the route from the west, thus allowing sufficient time for the water to subside, and in the end accomplish the same desired object. I travelled with horses as far as the eastern end of the Pend d'Oreille lake, when, owing to the high water rendering travelling, especially the crossings of the streams, difficult, dangerous, and in some places impracticable, I was compelled to leave my animals and take a canoe across the Pend d'Oreille lake, and down the Clark's fork as far as the Pend d'Oreille mission. Arriving at that point, I sent to Mr. Owen, at the Spokane prairie, for some horses belonging to the government then in his charge, intending to complete the remainder of my journey on horseback. I deem it unnecessary to refer here to the character of the lake on the Clark's fork, since a report on the same has been made to you already by Dr. Suckley. I would therefore simply state, that we found nearly all the tributaries to the Clark's fork from the north to be much swollen, and in fact perfect mountain torrents, rendering their crossings exceedingly dangerous and difficult. The Clark's fork was also much swollen, and flowing in places with an impetuous current. From the Pend d'Oreille mission I went to Fort Colville to procure supplies for my party, whence I travelled to the Spokane river, thence up this river to its junction with the Cœur d'Alene lake, thence to the Cœur d'Alene mission.

Arriving at the mission, I interrogated the missionaries as to their knowledge of the character of that region, and the feasibility of the same for the passage of trains of all kinds. They represented that the usually travelled route to the Bitter Root district was the one that you had followed in October, 1853; they mentioned, however, that there was another route only a few miles distant, which, owing to much fallen timber, was not travelled, but which they thought to be the better of the two. They spoke of a third route across the mountains, which from hearsay they thought might prove the most practicable and the best of the three. The Indians, however, who knew anything of this route were two days distant on the Wallah-Wallah road. I therefore deemed it advisable to visit them and interrogate them as to the latter route. Having found them encamped in the Camash prairie of the Cœur d'Alene, I told them my object in the country, and that I desired to gain information in regard to this particular route. Some said that the route was very difficult, leading over high and steep mountains; while others declared it to be the reverse, and offering no obstruction whatever to the full days' march of the traveller. Others affirmed that it was and had been their hunting-ground for years, which they did not want disturbed, and, with one accord, seemed unwilling to point out the route or show any friendly signs to have their country explored, or willing disposition to have their country travelled over by the whites. They, however, threw no direct impediment in my way; but, on the contrary, one of them accompanied me across the Bitter Root mountains. Finding I could not cross by this last-mentioned route, I concluded to follow the second. I returned to the Cœur d'Alene mission, which I left on the 19th of June, and followed the most northern of the two streams forming the Cœur d'Alene lake; and I have the honor to report that, except for a distance of twenty-five miles, I found the route to be over the same ground that you travelled over in October, 1853. Instead of following the right-hand trail in going eastward which you followed, I took the one to the left, and thus avoided the steep and high mountain crossed by your party; and though I found the route much obstructed by fallen timber, yet the character of the country offered no further obstruction to the passage of wagon trains, or for a railroad route, save the divide itself, which has an estimated height of fifteen hundred feet above the level of the valley, and which from base to base is from a mile to a mile and a half wide. The mountain is formed of schist rock and friable sandstone. At this point a tunnel, from a mile to a mile and a half, would be inevitable. By the peculiar formation of the valleys on either side, the summit of the mountain could not be gained by a single grade. By your estimate, this gap or pass is two thousand feet lower than the one you crossed, and is, in my judgment, the lowest gap in the range. It could be made a good wagon road by cutting and making a road along the side-hills, and having the road make one or more bends in gaining the summit. The present trail crosses and recrosses the river several times, but these, in a good measure, could and would be avoided by cutting a road on either bank, which is perfectly feasible. The stream flowing from the mountain to the St. Mary's river is called the St. Regis Borgia. The road at present is much obstructed by fallen timber, but this could be removed without much difficulty. I would have had my party at work on the road this summer, had not instructions ordering them to the Dalles been received by me in June last. I would mention, at this point, that Mr. Adams passed over this road from the Bitter Root valley to the Dalles of the Columbia in eleven and a half days.

This route, therefore, I pronounce to be the most feasible and practicable, and possesses advantages superior to any that I have examined in the whole range of the Bitter Root mountains. It is true that the route formed by the natural gaps of the mountain of the St. Mary's river and the Clark's fork of the Columbia is one involving no tunnel, but it does involve a length greater by two hundred miles than the Cœur d'Alene route. The surface-work forming the divide of the Bitter Root mountains I found to be friable, and apparently easily acted upon by the weather, and which I think would be found to be easily worked by the saw. I do not deem it necessary to go into details as to the character of the country from the St. Mary's river to the Bitter Root divide, since the party under your command examined it in October, 1853. Nor do I make mention of the country from the Bitter Root divide to Wallah-Wallah, since that has been passed over and examined by James Doty, Esq., in September and October last.

Having, therefore, examined this route previous to receiving your letter, I did not deem it inexpedient to follow a different route on my way to Fort Wallah-Wallah. The only route left to be examined in the whole range of the Bitter Root mountains, was the pass by what is called the Lo-Lo's fork of the Bitter Root river. The route had been represented to me by some to be very rugged and difficult, and by others as feasible and practicable. I therefore decided that, as Mr. Doty was to take the route by the Cœur d'Alene country, I would examine the Lo-Lo's Pass, and meet him at Fort Wallah-Wallah. Accordingly we left the Bitter Root valley together on the 19th of September, encamping at the crossing of the river, after a march of twenty miles; but owing to the straying away of one of my animals, we remained in camp on the next day, but resumed our march on the 21st, which commenced clear, bright, and pleasant. We halted a few minutes to make a sketch of the entrance to the Lo-Lo's Pass, when we crossed the river to the left bank. The stream, at the crossing, is well timbered with the cotton-wood and poplar, and is fifteen yards wide, with good banks on either side, and channel-water two feet deep. The mountains on each side of its valley, which here is five hundred yards wide, are quite high, and well timbered with the pine and cedar. The trails for six miles being on the left bank, through a low prairie bottom, at the end of this distance we crossed to the opposite bank, still finding an excellent road passing through beautiful pine openings. A short distance farther we crossed the stream a third time, when our trail, being up the left bank, passed over a series of side-hills, some of which proved quite steep and fatiguing to our animals. But little fallen timber was, however, found on these mountains. The growth being quite large, was consequently much scattered, thus affording a good road. Up to 3 p. m. we crossed two small streamlets coming in from the north, upon the second of which we halted to rest the animals, having travelled a distance of 20½ miles. A better road could be made by following the valley of Lo-Lo's fork. Of course, many crossings of the stream would be inevitable; but as the water here is very shallow, the crossings would be of minor importance, considering the advantages to be gained by a level road. Resuming our march at 4 p. m., we continued for three miles along the side-hills, through fallen timber, when we crossed and immediately recrossed the Lo Lo's fork. At this point we reached a very beautiful prairie, about one-third of a mile in length. This place afforded us an excellent camp; though, following the advice of our guide, we travelled a distance of four miles farther, when we encamped. Finding no grass, our animals started on the back trail an hour after reaching camp; but it being now sunset, it was too late to retrace our steps.

September 22.—Remained in camp during this day—our animals having strayed back to our camp of last night. Sent two men back in search of them, and in the meanwhile made a corral. The men arrived at sunset with all but four animals. We put them in the corral, where we kept them all night without grass, and on the morning of the 23d resumed our march at an early hour, our road for seven miles leading up and along the sides of very high and steep mountains, obstructed by much fallen timber, which proved very fatiguing to our animals. Gaining a high point of view, we had a prospect in every direction, where nothing was seen save an immense bed of high, rugged, pine-clad mountains. At the end of seven miles we again struck the Lo-Lo's creek at its forks. Here we found a small prairie, with very excellent grass, affording a fine camp to a large party. The many signs of elk tracks seen through this prairie, shows that this is a great resort for this animal—the great quantities of willow affording them an abundance of food. The mountains around this prairie are quite low and pine-clad. Our trail lay along the southern fork of the creek, which we crossed several times. The bed is covered with large rocks and boulders of sandstone. Each fork is ten yards wide, with bluff banks on either side. At a distance of two miles from the junction of the forks, we reached a range of hot springs, flowing from a bed of light, coarse-grained, friable sandstone. These springs are highly impregnated with sulphur, and are of the same degree of heat as those I found in the "Big Hole," the temperature of which was 132° Fahrenheit. Here occurs a small prairie, with very good grass, affording an excellent camp. The rock in the vicinity of these springs being easily disintegrated by the weather, presents quite a wild and picturesque appearance, being worn and rounded in every possible conceivable shape. They formed truly a relief to the eye from the monotonous character of the country through which we had been travelling. The accompanying sketch shows the vicinity of these springs, though no good point of view could be selected to sketch the rocks themselves as they appeared in nature. We stopped at these springs, where the men enjoyed a bath, and the animals the excellent grass here found. Leaving these springs, we commenced the ascent of the dividing ridge of mountains which separate the waters of the Bitter Root river from those of the Salmon fork of the Clearwater. This divide we found lower than the mountains along the Lo-Lo's creek, though covered with the pine, and in some places much obstructed by fallen timber. At a distance of seven miles from the hot springs we reached a prairie of two miles in length, where we encamped for the night. Through this prairie flows a small creek to the headwaters of the Clearwater, called by Messrs. Lewis and Clark "Glade creek." Here we found good grass; but it was with the greatest difficulty that we could restrain our animals from taking the back track, and only succeeded by guarding them during the whole night. Having been deprived of grass last night, we could not possibly tie them up or deprive them of grass. The night was clear and pleasant, though with a very heavy frost.

September 24.—We resumed our march this morning at an early hour, crossing Glade creek three times, when we commenced the ascent of a high and steep mountain about nine miles across, rendered difficult by stones, rocks, and fallen timber. At the end of this distance we struck the main northern branch of the Kooskooskia river, which we found to be a stream about ninety yards wide, flowing, with an exceedingly rapid current, over a rocky, stony bed. It is bounded on each side by high, steep, rugged pine-clad mountains. Crossing the Kooskooskia, we began the ascent of another very steep mountain, the road, in addition, being obstructed by fallen timber. For eight miles we continued up and along steep mountains, thickly timbered with the spruce and haematack. At the end of this distance our course tended for six miles more to the north, leaving the river at a distance of four miles to our left—our road still winding along and up steep, high, and rugged mountains. At a distance of four miles we reached the top of the mountains, where we could see in every direction, and nothing met our view but one immense bed of pine-clad mountains. There was a ridge to our south and east that had a general direction of northeast and southwest, presenting a series of high jagged peaks, all destitute of timber. Having travelled a distance of twenty-five miles, we encamped on the top of a high mountain, where we found a spring of water on the trail. We found no grass for our animals, and were compelled to tie the most of them without grass or water. We found growing along the sides and tops of the mountains to-day a great abundance of the bear-grass, which grows in large, long bunches, and retains its beautiful green color throughout the whole year. It is never eaten by the animals, however hungry they may be. We met to-day for the first time the mountain ash, growing in great abundance on these mountains in a bush form, and bearing a bright red berry. The tree is fifteen feet high. Towards evening our guide became embarrassed as to the route, as we came to a point of the mountains where the road forked. We, however, took the right-hand trail, which proved to be the present one travelled. When Captains Lewis and Clark crossed these mountains, they took the left-hand trail, which proved, by their description, as difficult, if not more so than the one we followed. At sunset, after a long and fatiguing march, we encamped on the summit of a high mountain, where we found a spring of clear pure water. The night was cold and windy, and on the following morning we experienced great difficulty in finding our animals; most of them broke loose during the night, and strayed off many miles into the thick timber, while some took the back track to our camp of last night. We sent two men on the trail, who found ten, and, having searched through the dense forest, we found them all by 11 o'clock. They presented a meagre and gaunt appearance, and showed the effects of the want of grass. At 12 m. we resumed our march. When at a distance of two miles we saw a deep hollow, with good grass. Here I sent one of the men to see if there was water. On his finding water, I concluded to encamp, although not midday, rather than travel with the prospect of finding no grass at our night camp. At this place we found an excellent spring of pure water, and an abundance of rich, green buffalo-grass. Towards sunset it began to rain heavily, with wind from east southeast, and continued with great force throughout the whole night. We had to-day a commanding view of the mountains, and took a sketch of the prominent ridge running northeast and southwest, it forming the great landmark of this region.

September 26.—Commences mild and pleasant, having rained heavily throughout the night. The atmosphere this morning was pure and pleasant. We resumed our journey at an early hour, our animals having fared well on the rich grass of last night. Our trail during the earlier part of the day lay up the sides and over steep mountains; but towards noon the road became perceptibly better, the mountains lower, and the trail easier travelled. We still had a commanding view of the mountains during the whole day, some of the higher peaks of which were covered with snow, especially the peaks of the prominent range referred to yesterday. To-day the mountains towards the north appeared very high and rugged, while those to our front and south still retained their rugged features. At a distance of fourteen miles from our camp we reached a spring of clear water on a bare mountain, having a beautiful southern exposure. Here we observed fresh tracks of horses—probably the Indians hunting. Six miles farther we saw a small lake. It was midway of a high, bare, steep mountain, on the southern side. A short distance farther we struck a small creek, running towards the north; and as we had travelled some distance without water, our animals scented it from afar, and were nearly frantic when approaching it. Here we reached a series of springs issuing from the sides of the mountains. Five miles farther we reached a large and beautiful prairie bottom, through which ran a pure mountain streamlet. Here the grass was most excellent and abundant, and formed a pleasant relief from our anxiety, as we fully expected to be compelled to encamp again without grass. The mountains to-day still continued covered with the white pine, mountain ash, alder, and balsam fir; though, as a general thing, the timber was more sparse to-day than any day since leaving the Bitter Root valley, the mountains in some places being formed solely of rock, principally freestone. We passed two creeks to-day, on the second of which we encamped.

September 27.—Commences clear, mild and pleasant. Having encamped high on the side of a mountain, we had a grand and pleasing view. The hills at our feet appeared swimming in lakes of mist, while the distant mountain-tops were lit up by the bright rays of a genial sun, and all nature seemed to wear a pleasing and smiling garb. We started at seven o'clock, our road during the whole day being along the sides and up the steep rugged mountains, the trail being obstructed by fallen timber, though not as difficult as yesterday and the preceding days. At fifteen miles from our camp we reached a large and bare mountain, where we found the grass most excellent, with several springs of clear pure water gushing from its side, affording an excellent camping ground. The mountains around still continued to be covered with the balsam fir, save those only which were formed solely of freestone. We observed to-day large numbers of the mountain grouse, the blue jay, and a species of the large rock squirrel, a specimen of which we preserved. After a march of twenty-five miles we encamped on the northern exposure of a mountain, where we found good grass and water.

September 28.—Resuming our march this morning, we continued along the sides of the mountains, rendered difficult by the great quantity of fallen timber along the trail, which at times led over the steep and rugged mountains, which proved truly fatiguing and trying to our animals. We still continued to be surrounded by a labyrinth of mountains, all clad with pine, balsam fir, mountain ash, honeysuckle, cedar and willow, with much underbrush, and some of the higher peaks covered with perpetual snow; numerous springs of pure cold water were seen flowing from mountain sides. At fifteen miles from our camp of 27th we reached a small creek running towards the north; three miles farther we reached a second creek, also flowing towards the north and running through a small but beautiful prairie, with good grass, affording an excellent camping ground. We had made only eighteen miles yet; the road had proved so fatiguing to our animals, that I concluded to encamp. The soil in this prairie we found most excellent, being of a rich dark-colored loam; in fact, with but few exceptions the soil of the route to-day has been most excellent, especially in the narrow gorges and the small intervening valleys of the mountains, the soil in some places being formed solely of the decayed leaves and timber; but in these places the ground is forever shaded by the exceedingly large trees found along the whole route. Immense beds of freestone were to be seen along the sides of the mountains, the presence of which was indicated by the outcroppings in many places. We observed to-day two species of grouse; one with a red segment, and the second with a yellow segment of a circle above the eyes. The latter weighs from two to four pounds. The flesh of these last is very excellent, and when cooked is very white and not unlike the ordinary grouse of the mountains. They are quite tame, and remain sitting on the ground except when frightened, when they betake themselves to the trees; they are of a lead-gray color on the breast, the feathers near the tail being speckled white and black; they make a hooting noise, not unlike that of the owl. We observed also many blue jays, small rock squirrels, rabbits, and mountain weasel, or mink.

September 29.—Commences bright and pleasant. We resumed our march at an early hour, our trail still leading over the high and rugged mountains, much obstructed by fallen timber. Gaining a high point of view, we caught a glimpse of the distant prairies, which was a sight truly refreshing after our rugged toiling through the mountains. The mountains to the north and south still continue to be very high, though, on account of the hazy, smoky atmosphere, we could not see them very distinctly. We noticed on the trail to-day for the first time great quantities of cedar, some of the trees growing to enormous sizes, though none so large as those in the Cœur d'Alene country, the largest that I measured being thirty-six feet in circumference. We noticed also the box, the white maple, the ground willow, and the cherry, the latter bearing a red bitter fruit, that tastes not unlike the green English cherry. No game save a single grouse was seen during the day. At seven miles from our camp we reached a small prairie with two small lakes, affording excellent grass. Here we observed the long-leafed pine, growing from ten to fifteen feet high. A few miles farther we reached a second prairie, through which flowed a small stream, towards the north. Our road for the remainder of the day led through an immense pine and cedar forest, being much obstructed by underbrush. Seventeen miles from our camp we reached a rapid stream of fifteen yards wide, flowing towards the west. We crossed a fork of this creek from the northeast. At its mouth it flows through high pine-clad mountains over a rocky bed. After travelling a distance of thirty miles we reached a large and beautiful prairie, with grass two feet high, through which flowed a stream two feet deep, towards the southwest, with a rapid current. We had thus descended the last of the rocky range, and had now before us an open and somewhat inviting country. We had thus been in the mountains eleven days, our road being rugged and rough during the whole time. The prairie upon which we to-night encamped extended for five miles in length and one in width, and was surrounded by thick pine forests. We had during the morning a view for the first time of the Blue mountains, about one hundred miles distant.

September 30.—We resumed our march at an early hour, following down the creek upon which we had encamped for a distance of two miles through pine openings, affording us an excellent and level road. Here the trail tended more to the north, leading over a series of hills covered with fallen timber. Here we reached a small creek from the east flowing through a low bottom fringed with willow, the sides of the hills or mountains being clad with pine. We followed this creek for six miles through beautiful pine openings with small patches of prairie, affording us an excellent road. In these prairies the soil is very fertile, being a rich dark loam. At the end of six miles we again entered the thick timber, crossing a small divide separating two creeks that flow into the Clearwater; the timber upon this divide we found to be principally cedar and fir. We soon fell upon the head of a second creek flowing towards the west, and called by the Nez Perces Indians Esh-ske-esh-skil, and two miles farther reached the main Camash prairie. It is two miles wide and six or eight in length, perfectly level, and enclosed on all sides by forests of pine growing from sixty to eighty feet in height. Through the prairie is a small creek or slough, around which they encamp during the camash season. It is a great resort for all the Indians in this vicinity, principally the Nez Perces, Cœur d'Alenes, and sometimes Spokanes, it being a favorite racing ground with all the Indians. Here we struck a large trail which tended to the Nez Perces' camp; this Camash prairie being sixteen miles from our camp of yesterday, and twelve to the Clearwater river. Six miles from the Clearwater we reached a large creek flowing with a rapid current over a rocky, stony bed, through high, rocky, steep mountains. This creek is called by the Nez Perces Nahwah; it is twenty yards wide, and empties into the Clearwater about twenty miles below the Nez Perces' camp; we crossed this creek and began the ascent of a steep mountain, the last of the Rocky and Bitter Root ranges. This mountain was formed principally of a light friable rock, containing much mica. Gaining the summit of this mountain, we had an excellent view in every direction. In front of us lay the broad ocean of prairie upon which we were about to enter, and behind us the immense bed of rugged and uninviting mountains with which we had been but too familiar. To the south lay distinctly in view some steep spurs of the Snake River chain towering high in the sky, while towards the north lay the rugged chain bordering the Cœur d'Alene country on the south. It was after sunset when we reached the Clearwater, which we found to be a stream one hundred and thirty yards in width, channel-water two feet deep, and flowing in some places with a rapid current, over a rocky and pebbly bed. The valley of this stream is about nine miles wide, and bounded on each side by high, steep clay banks, destitute of timber. While descending the steep hill to gain the river we met with large quantities of volcanic rock lying scattered over the ground, presenting a vesicular honeycombed surface. We crossed the Clearwater after dark, and at a mile distant reached a few lodges of Nez Perces Indians encamped on the Komyer creek. Here is the country of the Nez Perces Indians, where they have large fields enclosed, large herds of cattle, and an abundance of the fruits of nature. The soil here is very fertile, and the winters are represented as being very mild. They raise large quantities of wheat, potatoes, beans, peas, and onions. The Salmon river, which is only two days distant, affords them an abundance of fish. Large quantities of berries are found on the streams flowing into the Clearwater. Their Camash prairie is only twelve miles distant; nature thus affording them every advantage and every means of sustaining life, and causing them to live happily and contented. At present they are provided with no mill, the want of which they feel very much; at present they make use of the wheat by either boiling or pounding it.

The journey across the mountains having proved very fatiguing to our animals, I concluded to rest a day in camp with the Indians, and did not resume our journey until 4 p. m. on the next day, having been delayed in searching for some of our horses that had strayed from camp. We lost them yesterday, and though the men were in search of them all day, they were unable to discover them. I was disposed to believe my Indian friends had cached them; for it was only after offering them a large reward that they started in search of them, when in a few minutes they brought them in. I was at this place forcibly reminded of the national characteristic meanness and avarice of these Indians. I have met them many times in the mountains, and they have to me always displayed those same traits of character. I desired one of them to accompany me on my journey, but he demanded such an enormous reward for his services that I told him I preferred travelling alone to being imposed upon by them.

Resuming our march, our course tended over the high bluffs bounding the Clearwater on the south for a distance of three miles, our course being 5° north of west magnetic. At the end of this distance we reached the high, broad, rolling prairie, over which we travelled five miles, to a fork of the river now dry, but when supplied with water, flows through a deep, narrow, rocky gorge or ravine. At six miles farther we reached a second creek, containing water also, flowing through a narrow ravine, the creek being fringed with willow and a few broad-leafed cotton-wood trees; a few scattering pines were also to be seen growing along the slopes of the hills. Having travelled a distance of fourteen miles, we encamped on the right bank of the creek, having travelled until after sunset, in order to reach good grass and water. We found the old grass of the prairie burnt, but the young grass was now springing up. We had an excellent view of the Rocky mountains from the west, as also of the mountains bordering the Snake river, all being clad with the pine. The day was bright and pleasant, and the night clear and mild.

October 3.—Commences clear and bright, though cool. Ice made this morning about daybreak. Resuming our journey at an early hour, our trail lay over the rolling prairie for a distance of six miles, when we reached a creek emptying into the Clearwater, and flowing through a deep, narrow gorge of volcanic rock about one hundred feet deep. From this point, for eight miles, our trail lay over the rolling prairie, when we entered an open pine forest, through which we travelled for a distance of eight miles, when we reached a small creek running towards the west, and called by the Nez Perces Lappahwat, which we followed for a distance of six miles, when we reached the trading establishment of William Craig, where we encamped, having travelled a distance of twenty-eight miles. The Lappahwat valley is five hundred yards wide, bounded on each side by high, bare hills or bluffs, and the soil is quite fertile. Here we found several fields enclosed, and at night the Indians brought us onions, cantaleups, pumpkins, and tomatoes, being the first we had seen for twenty-one months; they proved truly refreshing. The climate here is mild, and all garden vegetables are found to grow well, and in the greatest abundance. The soil in many places is a rich loam, and about two feet deep; in fact, since leaving the mountains we have found the soil very fertile. Through this valley, as also in those already passed, we found large bands of Indian horses, and on arriving at Mr. Craig's we found hogs, goats, and chickens in great abundance.

October 4.—Commences bright and pleasant. Having secured a guide at the Nez Perces' camp, we resumed our journey, which lay down the valley of the Lappahwat to its junction with the Clearwater, thence down the left bank of the Clearwater to its junction with the Snake river or Lewis's fork of the Columbia, where we encamped for the night. The valley of the Lappahwat near its mouth we found to be half a mile wide, and contains many Indian farms; the soil here is very fertile, and large fields of corn and potatoes are here grown. At the mouth of this creek, on the right bank, is Spalding's old mission, which was abandoned after the Whitman massacre. This place being well sheltered by the high hills and bluffs of the valley, renders it a very desirable station for a trading post or a large farm, or an Indian agency. The grass along this route, however, we found very sparse, being either burnt, or destroyed by the large bands of horses roaming over it. The rock along these bluffs is volcanic. The valley of the Clearwater we found to be half a mile wide, and the river one hundred and fifty yards wide, and flows with a gentle and equal current to its mouth. At its junction with the Snake river it is nearly two hundred yards wide; the Snake river at the same point being two hundred and fifty yards wide, with a rapid current. The bluffs on the right bank are high and steep, and perfectly destitute of timber and grass, while those to the south are quite low, and covered with a rich growth of nutritious grass.

October 5.—Commences cold and rainy. It rained moderately during the night, accompanied by a heavy wind from the west; and having encamped on the bare rocks of the beach, our camp this morning proved truly uncomfortable. As soon as the wind had lulled, we crossed the Snake river in a canoe that we had secured the day before. We made the crossing without difficulty, and at 12 m. resumed our march along the left bank of the Snake and Clearwater rivers; the water is of a deep sea-green color, and is very deep. The banks are formed of gravel and rounded water-worn stones, the marks on which show that at the high stage of water the river is from ten to fifteen feet higher than we found it. Our road along the Snake river was much obstructed by rocks and stones for a distance of seven miles, when we reached a great bend of the stream, the river turning towards the north, which here is two hundred yards wide, and flows with a rapid current, with falls and cascades, through high, steep bluffs or hills; those on the right bank being covered with a very sparse growth of grass, while those on the left are formed mostly of columnar rock, fragments of which are continually falling, obstructing the pathway along the whole route. On reaching the bend referred to we left the river, our course being nearly due west. Here we reached a small stream or run flowing from the west, through high, steep bluffs, similar in every respect to those along the Snake river. This creek is called by the Nez Perces the Alpahwah. It is bordered by the willow, long-leaved cotton-wood, birch, sumach, cherry, white haw, honeysuckle, and gooseberry. It is from eight to ten yards wide and fifteen inches deep, and its valley bordered on each side by high, bare bluffs. Having travelled a distance of twelve and a half miles, we encamped on the left bank of the Alpahwah, at its forks, finding very good grass and an abundance of wood. On reaching the Snake river this morning, the guide, who was a Shawnee Indian who had accompanied us from the Bitter Root valley, desired to return. Permission was granted him, when he returned on foot, packing his saddle aud bedding to the nearest Indian camp. The rain, which poured in torrents during the earlier part of the day, abated towards noon, but recommenced at 3 p. m., and continued with force till night, accompanied by a heavy wind from the west. At 7 p. m., however, it ceased, with a clear sunset, giving promise of a bright morrow. The soil along the route to-day, where not covered with rocks and stones, we found fertile, and is well adapted to the growth of corn, potatoes, and wheat, together with many garden vegetables. We saw several fields that had been enclosed by the Indians, in which were standing the stalks of corn and the remains of wheat and vegetables. The Indians little understanding the art of agriculture, secure from the soil not more than one-fourth of that which it is capable of yielding. They are badly supplied with farming utensils, and are compelled to use any and every thing, such as sticks, horns of animals, &c., in tilling their crops. Their fences are roughly and rudely made, being mostly formed of underbrush and bushes, the twigs of which are interwoven with each other, thus affording a very weak and insecure protection against the bands of horses that they possess. Many fine bands of horned stock were to be seen browsing along the borders of the streams, while large bands of horses nearly wild were to be seen along the tops and ridges of the bluffs. The country to-day we found much cut up by trails and roads leading in every possible conceivable direction, and which were well calculated to confuse the traveller.

October 6.—We resumed our march this morning up the eastern fork of the Alpahwah for a distance of two miles, when we ascended the bluffs bounding it on the west. Gaining the top, we reached the broad rolling prairie, over which we travelled for a distance of five miles, when we reached a small stream called the Pelahat, flowing towards the west. The valley of this creek is half a mile wide, and covered with a most beautiful growth of nutritious grass. It is ten yards wide, fifteen inches deep, and timbered with the white haw, cotton-wood, and willow, but principally the latter. It is bounded on each side by a range of prairie bluffs about one hundred and fifty feet high, and covered with a rich growth of grass. Travelling down its right bank for a distance of seven miles, we crossed to the opposite bank, and at a distance of two miles crossed over a series of rolling prairie hills for three miles, when we reached a beautiful creek, called by the Indians and others Two Cañon. The valley where we struck it is eight hundred yards wide, and bounded on each side by high, steep, and in some places rocky bluffs, two hundred feet high. The stream is fifteen yards wide, and twelve inches deep, and bordered with the cotton-wood and willow, principally the former. The grass here we found to be indifferent and sparse, though the soil is quite fertile. On this creek lives a trader by the name of Marangois, a Frenchman, who has several fields enclosed, and with a large family lives quite comfortably. The Two Cañon forms the southern boundary of the Nez Perces and Cayuse Indians. Leaving this creek, we travelled over a beautiful valley prairie for a distance of ten miles, when we struck the northern branch of the Touchet, which we found to be a large and bold stream, flowing through a valley a mile wide, and bounded on each side by a range of beautiful hills. There is no stream that we have found, from the mountains to the Dalles of the Columbia, which is as well wooded as the Touchet, nor is there found in any of the valley bottoms soil of a richer character than that found in this valley. The winters are represented as being mild; thus affording every inducement to the grazier and the farmer. Having travelled a distance of thirty miles, we encamped on the left bank of the stream; and the next morning, making an early start, we reached at 4 p. m. the ranche of Messrs. Brooks, Bamford, and Noble, where we rested a day to refresh ourselves and animals. The country travelled over was a rolling prairie, and many of the bottoms were exceedingly rich and fertile. Large bands of Indian horses were seen along the hill-tops, and through the numberless bottoms of the rolling country. I have seen no country superior to that of the Nez Perces and Cayuse Indians, and which offer to the grazier and the agriculturist inducements which are rarely surpassed in any region. The grand recommendation and capability of this whole region is its peculiar adaptation to grazing purposes; and were it well wooded, could not be surpassed by any section west of the Rocky mountains.

Resuming our march on the 9th, we reached Fort Wallah-Wallah, where we met the party under James Doty, Esq., who had taken the Cœur d'Alene route, and arrived the day previous Securing some fresh meat at this point, we took the river road, by the Columbia, to Fort Dalles, where we arrived on the 14th of October, when a portion of my party were discharged, and the public property turned over to the quartermaster.

Taking a retrospective view of the country passed over from the Bitter Root valley to the Nez

Perces' camp, I can arrive at but one conclusion—that the route is thoroughly and utterly impracticable for a railroad route.

From the head of Lo-Lo's fork to the Clearwater the country is one immense bed of rugged, difficult, pine-clad mountains, that can never be converted to any purpose for the use of man.

This is the route followed by Messrs. Lewis and Clark, in 1804, and by Dr. Evans, the United States geologist for Oregon, in 1850. In a conversation with the latter named gentleman, he told me that it is by far the most difficult and uninviting country that he has ever examined in all his tours through the Rocky mountains; and I am compelled to say that, in all my explorations in that region, I have never met with a more uninviting or rugged bed of mountains. The whole country is densely timbered, save at a few points where small patches of prairie occur sufficiently large to afford camping grounds; but beyond this it cannot be converted to any useful purpose. The country from the point where I crossed the Clearwater to Fort Wallah-Wallah is a high-rolling prairie, and is well adapted to agricultural and grazing purposes, and affords an excellent home for the Indians inhabiting that region.

Having examined three routes across the Bitter Root mountains, I pronounce the one by the Cœur d'Alene country to be the most feasible and practicable; the only obstruction from the Bitter Root valley to the Snake river being the divide of the Bitter Root mountains, which would involve a tunnel of a mile to a mile and a half long, and the crossing or bridging of the Bitter Root or St. Mary's river. Should the line along the Cœur d'Alene lake and Spokane river be the link from the mission, no bridging of streams would be necessary save that of the Spokane river, which, during low water, is fordable, and which never rises over four feet; it has good banks on either side, and in many places could be bridged by a single span or arch. But should the lines direct to Wallah-Wallah be the route chosen, it would involve the necessity of bridging the two guts of the Cœur d'Alene lake, which could be done by a single arch each. I refrain from entering into details at this point of the route, since it has been examined and will be reported upon by Mr. Doty.

Accompanying this I submit a map of the country travelled from Cantonment Stevens to Fort Dalles, together with a series of sketches characteristic of the different points of my route.

Very respectfully, your obedient servant,

J. MULLAN,
Lieutenant United States Army.

Governor I. I. STEVENS,
In Charge of Northern Pacific Railroad Survey.

LETTER OF GOVERNOR I. I. STEVENS TO THE SECRETARY OF WAR, ADVISING THE CONDITION OF THE SURVEY, AND TRANSMITTING REPORTS OF LIEUTENANT JOHN MULLAN, U. S. A., AND MR. GEORGE W. STEVENS.

OLYMPIA, W. T., *January* 3, 1855.

SIR: I have been prevented, by delays on the route from Washington city to this place, and the time required to examine reports and adjust accounts, advising you earlier of the condition of the survey of my route.

The winter parties returned in October. The reports of Lieut. Mullan have been handed in, and will be forwarded by this mail. Those of Mr. Doty will be ready in a few days. By the next mail I hope to be able to forward them to the department. I will observe that, for the want of the proper instruments, the field barometers being either broken or out of order, no profile was brought in by either party, and, excepting the observations at the fixed stations, no additional observations were made to test the profiles submitted by me, and of which the observations have been lost.

I have already submitted my views in full as to the additional work required on my route. The importance of a comparative survey of the lines of the Columbia river and the Snoqualme Pass was dwelt upon, as well as of surveys to show whether the Little Blackfoot passes of the Rocky mountains could be reached from St. Paul by a more direct route, crossing the Missouri and Yellowstone, and direct from the western frontier of Iowa and Missouri by a route through the Black Hills. The intermediate routes were also referred to, and much stress was laid upon the importance of making a survey of the general route pursued by me over the Cœur d'Alene mountains in October, 1853, to determine whether it was practicable for a railroad, thereby abridging the distance nearly one hundred miles, as well as upon a survey of the route pursued by Lieut. Mullan in March last, on his return from Fort Benton.

Without going further into particulars, I have the honor herewith to enclose a report of Lieut. Mullan, urging the importance to the complete exposition of the character of the northern route, that a profile should be run up the Missouri to Fort Benton, and thence by the Northern Little Blackfoot Pass and the Cœur d'Alene route to the Columbia valley. Lieut. Mullan's route over the Cœur d'Alene mountains differs from my own in following a trail over the divide a few miles farther north. The pass is much lower, and, in the judgment of Lieut. Mullan, perfectly practicable for a railroad, and involving a tunnel from a mile to a mile and a half in length. But little work is required to make it perfectly practicable for wagons.

I have the honor herewith to enclose a copy of Lieut. Mullan's report, and to recommend it to the favorable action of the department. His estimate I consider reliable, and his plan of operations perfectly practicable.

Should Congress make an appropriation for a military road from Fort Benton to Wallah-Wallah, it could not be placed in better hands than Lieut. Mullan's, and thus a test be furnished to the work on the railroad exploration, as pointed out by him, at a much smaller sum than is given in his estimate.

I also have the honor to enclose the copy of a report by Mr. Stevens, submitting a plan and estimate for determining with accuracy the latitudes and longitudes of the principal stations, with the view of making the past observations available, and to recommend its adoption by the department.

Recapitulation.—Estimate of Lieut. Mullan, $5,000; estimate of Mr. Stevens, $5,500; total, $10,500.

I am, sir, very respectfully, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

REPORT BY LIEUT. JOHN MULLAN, U. S. A., ON A PASS IN THE ROCKY MOUNTAINS AND A PASS THROUGH THE BITTER ROOT MOUNTAINS.

OLYMPIA, W. T., *December* 12, 1854.

SIR: I have the honor to submit for your consideration the following brief report on a pass in the Rocky mountains and a pass through the Bitter Root mountains, which I found in my explorations during the present year.

As you have already been informed, I found a pass in the main chain of the Rocky mountains, in March last, through which I travelled with a wagon, without the slightest difficulty. The approaches to this pass from either side are easy and gradual—superior by far to any that I have met in my examinations through the mountains. This pass connects with the falls of the Missouri by a high-rolling prairie country on the east, and directly with the valleys of the Little Blackfoot and Hell Gate rivers on the west.

During my examinations, my time was devoted more to reconnaissances than to detail surveys. This was necessary, owing to the very meagre and unreliable information that was at our disposal from any and every source. Had a detail survey been made over one route, to the exclusion of a second or more in that particular region, it would not, I fear, have given satisfaction either to the department or to yourself; and I am confident that I should not have been enabled to give a decided and positive opinion as to the superiority of one over another; for had the time been spent in examining minutely one particular line, and it, in the end, been found impracticable, it might have been possible that a better route was to be found to our right or our left, and yet we be perfectly unconscious of it.

Taking the view, therefore, that the mountains should be examined and reconnoitred in a general manner, in order to discover and explore such passes as might exist, I devoted my time and labors in carrying out this plan. In so doing, I went through several passes, and this one in the Rocky mountains I now refer to I deem the most practicable of all.

But, owing to the want of proper instruments, after its discovery I was not enabled to give its position astronomically or its accurate profile. Suffice it to say, however, it is the best pass I have yet found in the mountains, with excellent approaches on either side. This pass extends to the Bitter Root and St. Mary's valleys, by the Hell Gate defile. The route then followed is by the Bitter Root valley to the mouth of the St. Regis Borgia creek; thence up this creek to the divide of the Bitter Root mountains, to the north gut of the Cœur d'Alene lake; thence either by the Spokane river to the Columbia, or by crossing the two guts of the Cœur d'Alene lake to Snake river, at or near its great bend in the vicinity of Fort Wallah-Wallah, or avoiding the Snake river *in toto* by striking the Columbia over a high-rolling prairie country to the mouth of the Yakima.

I deem an instrumental survey of these two passes to be vitally necessary, in order to show their relations to the passes already explored and surveyed, and at the same time show their advantages as compared to the passes already examined through the Rocky and Bitter Root ranges of mountains; and I further deem them essentially necessary, in view of a final report upon this great and momentous question.

Were there no other consideration to induce this, the fact alone that the barometric profiles of the expedition were lost while on their way to Washington city, is, in itself, a sufficient argument to have a more thorough examination made in that interesting region of country.

Owing to the action of the Indian Department, in conformity to an act of the last Congress, authorizing it to hold a council with the Indian tribes at Fort Benton during the coming season, I would suggest the following plan, which might be submitted to the Hon. Secretary of War for his approval or disapproval.

Presupposing that a large force will be present at the council, a party of one officer and four employés might be authorized to accompany it for protection as far as the falls of the Missouri from St. Louis. A party so starting and so organized could determine the latitude and longitude of those points of the Missouri to the falls not yet determined, as well as ascertain the heights above the sea of the principal points along the route; thus giving the profile from St. Louis to the Great falls of the Missouri. The party then starting from the falls would be enabled to make a detail and instrumental survey of the two passes I refer to, even so far as to running a line of spirit-levels through the passes, with their approaches on either side. Thus taking advantage of this council to be held at the falls of the Missouri, a party of five men would be complete in itself, and would be enabled to develop the same facts that it might take a party of twenty-five or thirty—the smallest party that could be sent with safety into that country—supposing them to take advantage of the presence of the men who will necessarily be at the council.

Taking into consideration the exceedingly economical and small scale upon which such an expedition could be carried on, it does seem to me that, upon a proper representation being made to the Hon. Secretary of War, he must necessarily see the great advantage flowing from it.

I have estimated that a sum of five thousand dollars will thoroughly and efficiently organize the party, keep it in the field, and cover any and every expense attending it under the most unfavorable circumstances.

Considering, therefore, the great ends to be accomplished, I would most respectfully lay before you this letter for your consideration.

Truly, your most obedient servant,

J. MULLAN,

Lieutenant U. S. Army.

Governor I. I. STEVENS.

REPORT OF MR. GEORGE W. STEVENS, SUBMITTING A PLAN AND ESTIMATE FOR DETERMINING WITH ACCURACY THE LATITUDES AND LONGITUDES OF THE PRINCIPAL STATIONS ON THE ROUTE NEAR THE 47TH AND 49TH PARALLELS.

OLYMPIA, W. T., *December* 21, 1854.

SIR: In the progress of the main train of the Northern Pacific Railroad Exploration and Survey, it was intended to make, at several of the important points on the route, observations of moon culminations with the transit instrument, for the accurate determination of longitudes; but on taking the field it was found that marches must be made with far greater rapidity than was anticipated, and that time would not admit of this instrument being set up for a sufficient length of time at any of the proposed stations. Throughout the whole route, the sextant was used upon every favorable night for the determination of time and latitudes. The latitudes thus secured are good throughout, and the chronometric longitudes might be made of use had we accurate determinations of the principal stations from which to check them. The method of lunar distances was not made use of, from the knowledge of the fact that the best observations give but inferior results, and my own limited experience would not authorize their attempt. Nor was the astronomical party supplied with a telescope suitable for observing the eclipses of Jupiter's satellites and occultations of fixed stars by the moon.

Could the route be again traversed with a small party under my direction, whose movements might be entirely independent of those of a large train with other duties to perform, and the transit established at the principal stations during at least one lunation at each, not only might the stations so occupied be determined with close approximation to the truth, but the observations at intermediate camps made on our way from the Mississippi might be brought into use.

Olympia has been occupied during the past summer as such a station, and the observations made, whenever the weather would permit, give a good determination for this point.

I would most earnestly ask that the opportunity may be afforded me of recrossing the northern route, and I would submit the following as a programme of operations, which would serve the requisite ends:

To occupy Wallah-Wallah, Pend d'Oreille lake, (its eastern extremity, where the Clark's fork enters it,) St. Mary's village, Fort Benton, Fort Union, and Sauk rapids, our point of departure from the Mississippi, as transit stations.

At each of these stations, besides the observations of moon culminations, observe all the occultations available, and eclipses of Jupiter's satellites. The longitude determined by an occultation is deemed more reliable than by the other method, when made under favorable circumstances, and made in connexion with transit observations is particularly valuable. In so high latitudes as those of this route, the atmosphere is not so favorable for observing the eclipses of Jupiter's satellites as in the lower latitudes; nevertheless, they will give very fair results. They may be observed quite frequently while en route, and thus serve as checks on the chronometric longitudes. As the long stay at the principal stations will afford the means of obtaining excellent observations for the rates of the chronometers, it is believed that the position of every camp may be determined with a near approximation to the truth.

Occultations are of rare occurrence, and it can hardly be expected that more than two, possibly but one, can be observed during a lunation.

At each principal station, extended series of latitude observations with the sextant should be made; and also the latitudes of the camps en route be determined.

The requisite instruments are in store at this place; consequently no outlay for instruments is needed. The party should contain, besides an assistant, three packers and a cook. The principal expenditures would be for the services of the members of the party, their subsistence and transportation.

With a small appropriation, therefore, these observations can be made, and their value cannot be overrated. Although a list of longitudes might have been obtained on our route hitherward, the rapid marches and all the circumstances of the movements of the train were such, that *good results* could not have been secured. With an appropriation enabling the carrying out of a programme similar to the above, I think such positions can be determined as will answer for the ground-work of a map published in the year 1855, and which will not be materially corrected by future explorers who may visit these points.

I have estimated $5,500 as the total cost of the proposed operations.

From Fort Benton I would propose, as the chronometers kept tolerable rates from the Mississippi to this point, to descend the Missouri to St. Louis, stopping to occupy Fort Union as a permanent station, and making the usual camp observations all the way. Afterwards, I would propose to visit Sauk rapids, and occupy that station. By this arrangement a great expense may be saved, and every object be effected. Should a steamboat be chartered for the Blackfoot council, I could probably connect with her at Fort Benton; otherwise a row-boat can there be obtained in which to descend the river to the settlements.

I have made the following programme of the periods to be allotted for the occupation of each station as far as Fort Union. The distances separating them can be easily made in the times intervening:

At Wallah-Wallah, from April 20 to May 10.
At Pend d'Oreille lake, from May 20 to June 2.
At St. Mary's village, from July 17 to August 6.
At Fort Benton, from August 16 to September 5.
At Fort Union, from September 18 to October 5.

Should the appropriation asked for be made, it is to be hoped that I may be able to reach Wallah-Wallah at the time above specified; otherwise another lunation must be awaited.

It is indispensable that a portable observatory, with a stand for transit, should be carried along, as at none of the stations proposed to be occupied for an extended series of observations can the proper materials for their construction be procured. A stiffly braced frame, with roofs, sides, &c., of water-proof canvass, may be made, which will not be very difficult of transportation.

Very respectfully and truly yours,

GEO. W. STEVENS.

His Excellency I. I. STEVENS,
Governor of Washington Territory.

LETTER OF GOVERNOR I. I. STEVENS TO THE SECRETARY OF WAR, TRANSMITTING TWO REPORTS OF MR. JAMES DOTY.

OLYMPIA, W. T., *April* 20, 1855.

SIR: I have the honor herewith to enclose two reports from Mr. James Doty—the first dated at Olympia, December 15, 1854, giving the results of his exploration from Fort Benton, along the eastern base of the Rocky mountains, to latitude 49° 30′; the second dated at Olympia, January 1, 1855, giving the results of a reconnaissance from Fort Benton to Cantonment Stevens in July, 1854, and of a survey from Fort Benton to Olympia in September and October, 1854.

These reports will close my series of preliminary reports in relation to the exploration and survey of the northern railroad route, under the original instructions of the War Department. If, in the course of my Indian duties the present season, additional information shall be gained, I will submit it to the department for such disposition as may seem to the department appropriate.

By referring to the first report it will be observed that there is every probability of the existence of a wide, open pass, formerly in extensive use by the Indians, some twenty miles south of the pass explored in October and November, 1853, by A. W. Tinkham, Esq., assistant engineer.

I will extract as follows from that report:

"*May* 24.—The Marias river comes through a gap in the mountains some fifteen miles in width. The country is hilly, and densely timbered with pine; but the soil is rich, even in the highest hills. There are, however, many grassy openings or small prairies from one to ten acres in extent. From a peak of mountains, next below the highest range, I obtained a good view of the course of the river, and found that it runs northeast, while Mr. Tinkham's survey makes its course southeast. His description and topography of the pass and mountains do not agree with the reality, and it would certainly seem as though he could not have passed through here. Farther, directly up the main stream, is impracticable; but this wide depression, and no mountains to be seen in the west, would seem to indicate the existence of a favorable pass on some of its branches. A sextant observation at noon gives for the latitude of our camp 48° 20′ 59″, which is more than twenty miles south of the location given this river by Mr. Tinkham."

Again:

"At a distance of four miles more I ascended a lofty hill, from the summit of which I obtained a commanding view of the pass and the course of the river for a long distance to the southwest.

"The pass continues about fifteen miles in breadth; the country hilly, and densely wooded with pine. The mountains on either hand are lofty and rugged, showing generally perpendicular rock from within three hundred feet of their summits, and are covered with snow as in midwinter. Snow-banks were also found on the north side of many hills in the pass. Up the pass to the southwest no mountains obstruct the view, and I am satisfied that Mr. Tinkham could not have passed over this trail, as he could not pronounce this portion of the pass so difficult as his report and topography represent it. This pass is not vouched for as a good railroad or pack-train route; yet it is believed worthy of further examination, and I only regret that I cannot make it, as your instructions require me to be at Fort Benton in the last days of this month."

The second report gives much detailed information in regard to the railroad practicability of Lewis and Clark's Pass of the Rocky mountains, a comparative view of the merits of the Big Blackfoot and Northern Little Blackfoot trails, and the details of a new route—the route from the Cœur d'Alene mission to Fort Wallah-Wallah.

A sketch accompanies these reports.

I am, sir, very respectfully, your most obedient,

ISAAC I. STEVENS,
Governor of Washington Territory.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

REPORT OF MR. JAMES DOTY OF A SURVEY FROM FORT BENTON, NEAR THE GREAT FALLS OF THE MISSOURI, ALONG THE EASTERN BASE OF THE ROCKY MOUNTAINS, TO LATITUDE 49° 30′ N.

OLYMPIA, W. T., *December* 15, 1854.

SIR: I have the honor to submit the following report of a survey from Fort Benton, near the Great falls of the Missouri, along the eastern base of the Rocky mountains, to latitude 49° 30′.

May 10, 1854.—Morning cloudy and cool, with the thermometer 47° at 7 a. m. Had the horses brought up early, but it took a long time to pack them, especially the mules, which were very unruly on account of their long furlough from work. At 11 a. m. left Fort Benton, heartily glad to be out of it, and once more in the plains. My party consisted of Hugh Monroe, interpreter and guide; Henry Koaster and Benjamin Lint, soldiers; and an Indian boy to lead the odometer, which was fixed on a light pair of wheels drawn by one horse. Taking a course about south 20° west, passed up the Missouri river, and struck it at the mouth of a large ravine known as the "Big Coulée." Here we camped, having made 11½ miles.

May 11.—Morning clear and very warm. The mules were difficult to catch and pack, and we made a late start. Took a course for the Great falls, endeavoring to keep near the river. Crossed a number of deep ravines, and finally came to some that were impassable, and were compelled to go around them. These ravines commence in the dividing ridge between the Missouri and Teton rivers. They are narrow, one hundred and fifty to three hundred feet deep, with a steep descent to within fifty feet of the bottom, and for the remaining distance are perpendicular walls of red sandstone. Saw during the day numbers of antelope. At 5 p. m. had a thunder-shower, accompanied by a srong and very cold wind from the north. Just at sundown heard the roar of the falls, and saw the cloud of spray always hanging over them. The descent towards the falls is by an easy slope until reaching a nearly perpendicular descent of fifty feet, over red and gray sandstone rock. Descending this, we found ourselves upon a grassy plateau three or four acres in extent, the descent from which is also perpendicular, excepting in one place, where the mules got down. This brought us nearly on a level with the river; and crossing a luxuriant grass plat, and down another stair or step, we were at the water's edge. Here we encamped, almost under the Great falls, and in the identical place where Lewis and Clark encamped when they ascended the Missouri. Made to-day 28.77 miles.

May 12.—Morning clear and very warm, even before sunrise. Being much in need of fresh meat, I went hunting in the hills, and in an hour killed an antelope. After breakfast I examined the falls. They are about eighty feet in height, formed by a barrier of limestone and hard red sandstone, and the perpendicular bluffs on either side of the river are of the same formation. Immediately below the falls is a point of rocks extending one-third of the distance across the stream, and terminating in a platform two hundred feet square and fifty feet high. When the river rises this rock becomes an island, as is evidenced by the large piles of drift-wood lying upon the point connecting it with the shore. From this rock is obtained the best view of the "Great Falls" of the Missouri, which, although not equalling Niagara in grandeur and sublimity, yet presents a grand and beautiful scene; and looking upon it in the wildness and loveliness of the plains, the snow-clad peaks of the Rocky mountains in full view, reflecting that it is 2,500 miles from civilization, and how few white men have seen it, it presented to me a scene full of interest. The narrow bottom skirting the river below the fall extends some eighty rods in length, and contains about five acres. Upon it are growing a few dwarf cotton-wood, red cedar, box alder, and cherry bushes. I noticed here several varieties of flowers. Of the grizzly and brown bears, so numerous here in the days of Lewis and Clark, no trace remains save a solitary den in the rock, where some huge grizzly passed the winter.

Had much difficulty in getting the mules up the rocky road they came down, and it was 11 o'clock before we were fairly under way. Took a course northeast, to head the coulées, and then turned nearly due south. In four miles passed near the upper fall, which I visited last winter. Passed over a level or slightly-rolling plain, and in fifteen miles reached Nah-too-see or Medicine river, eight miles from its mouth. Having directed the men where to encamp, I rode down the river. Sun river, at its junction with the Missouri, is one hundred and seventy-five yards wide; deep, with a strong current. It does not overflow its banks, although they are no more than six to eight feet high. It is different from other streams in this country, in passing a broad valley bounded by hills of easy slope. The course of the Missouri is here northeast, and its banks are low. The soil is a light, sandy loam, of considerable fertility, and bears a luxuriant crop of grass. The timber is poor, consisting of cotton-wood of small growth, white willow, birch, and box alder. As a location for an agency and farm, this does not compare favorably with the Highwood river, where the soil is better, timber and stone abundant, and the distance to the head of navigation on the Missouri only eighteen miles, while from here it is thirty-five miles. Saw a large number of geese, two of which I killed. Reached camp at sundown. Made to-day 19.66 miles.

May 13.—This is a clear, warm morning. Up early, and at 8 o'clock started up the river. The travelling is very bad. Heavy storms have passed here lately, and quantities of hail are still to be seen in the hollows, and the ground is so soaked with rain that the horses sink to their fetlocks in mud as tenacious as glue. Finding it impossible to travel here, we made a detour to the right, keeping on the hills, where the road is better. Struck the river again in a few miles, and continued up the river. Noticed to-day many birds commonly seen in the Western States, as the meadow lark, red-winged blackbird, cow birds, pigeon hawk, black eagle, robin, swallow, plover, mallard duck, teal, &c. It is impossible for me to procure specimens of birds, as I have no fine shot.

Procured several varieties of flowers, which were carefully preserved. The river is becoming shoaler and more rapid. The country continues the same as near the mouth. Encamped at an early hour at the foot of a large island more heavily timbered than any point below. Half a mile below my camp is where the main train crossed the river, and, passing to the north of Crown Butte, entered the Blackfoot Pass. Crown Butte and the Big Knee near it are lofty, flat-topped buttes, called by the Indians the Rattlers, and are prominent land-marks, indicating the position of the Blackfoot Pass and Lewis and Clark's Pass. They can be seen from the Highwood mountains, sixty miles distant. Made to-day 23¼ miles.

May 14, *Sunday*.—To-day we remained in camp, as I am opposed to travelling on the Sabbath when there is not the slightest necessity for so doing. After breakfast I walked up the river, in the hope of finding some specimens for the natural history collection, but was entirely unsuccessful. Excepting a number of new flowers, I saw nothing worth collecting. Returned to camp at sundown. Barometrical observations have been taken at proper points upon the route, and also observations in camp.

May 15.—Morning clear and pleasant, but cool. Passed up the valley, keeping close to the river, and in five miles came to a flat-topped butte; continued along its base in a narrow bottom, and in twenty miles found that the river washed the base of the butte, which is here of gray sandstone, rendering farther progress in this direction impracticable. Turned back, and made a long detour to the right, and struck the river again opposite two large islands, and here we encamped, having made 24.52 miles. One mile from here we crossed Mr. F. W. Lander's trail, which is not correctly laid down on the map. The river does not fork here, and channels between islands must have been mistaken for the three forks laid down. Collected to-day six new varieties of flowers, but saw no snakes or reptiles. Country the same as passed over yesterday; grass luxuriant; hills low, and no coulées. Night clear and cool.

May 16.—Moved early, keeping now on the high ground, and cutting the bends of the river as the valley is becoming narrow. Country more broken, and soil better than I have yet seen. River bends more to the west, and we are now travelling directly towards the mountains, the more lofty of which are covered with snow. On our right, about the centre of the great semicircle formed by the mountains, stretching from the gate of the mountain on the Missouri to the sources of Sun river, stands a lofty, conical shaped mountain, called by the Indians Hart mountain; it is ten miles from the main chain of mountains, and is a very prominent landmark, indicating the position of Lewis and Clark's Pass, and another pass on the south fork of Sun river.

Night clear and cool. In the afternoon passed a large fork coming in on the south; it is nearly as large as the main stream, and does not appear to have an extensive valley in the mountains. Just above this I killed a large elk, and therefore I call this "Elk fork." The country continues to grow more broken, and the soil richer. Collected several new specimens of flowers, but no birds or reptiles. Encamped early, having made 23.45 miles.

May 17.—Moved early, and leaving the river on our left, struck for a towering snow-capped peak, which appears to mark the spot where the river comes out of the mountains.

The face of the country clearly indicates our approach to a great mountain range. Huge fragments of granite, limestone, sandstone, and a few granite boulders, are scattered over the plain. Noticed outcroppings of strata of sandstone and limestone, with a nearly vertical dip, running north and south. In fourteen miles came to scattering scrub-pines, being again near the river, and in one mile more extend to a lovely valley some two miles in breadth, and extending up the river three or four miles. This valley is elevated above the river some two hundred feet. The soil is a rich gravelly loam, grass luxuriant, and a profusion of gay colored flowers. Near the upper end of the valley are two small lakes, in which numbers of water-fowl were swimming. Pushed on as far as it was practicable to take the odometer wagon, and encamped on the edge of the river in a narrow bottom, fringed with a few pines and red birch.

May 18.—To-day I remain in camp to determine the latitudes, examine the mountains for a pass, and to collect specimens. Started early up the river on foot; valley narrows, bottoms disappear, and the river is shut in by precipitous mountains. Climbing along the side-hill over masses of rock fallen from the precipices above, came to a narrow strip of level ground along the stream, and following it, in eighty rods reached a perpendicular wall of limestone rock one hundred feet high, in which is an opening twenty feet wide, and extending from top to bottom, and through this the river flows in a swift, deep current. I have named this the Gate of Sun river. The sources of Sun river are evidently far up in the mountains, and, being very anxious to make further explorations, I attempted to climb the rocks on the right bank, but did not succeed. I then ascended one of the peaks next below the highest, which it was impossible to ascend; and the view from this point was magnificent. Above and around were snow-covered hills and the breath of winter, while the luxuriant grass and gay flowers in the valley far below were fast approaching maturity under the summer's sun. Collected twenty new varieties of flowers and a few geological specimens; returned to camp, and took a meridian altitude of the sun, which gives for the latitude of this camp 47° 32′ 39″, which agrees very well with the position as given by the compass and odometer line. There is no timber here suitable for building purposes; the pine is small and scrubby, and is only fit, perhaps, for railroad ties. The soil is excellent; but there is not a sufficient extent of level land to render it a good location for farms.

May 19.—Morning clear and warm; made a late start. Our course lay close along the mountains, over hills of considerable elevation, covered with scrub-pines twenty to thirty feet high, through which we had much difficulty in taking the odometer wagon. In fact, this delays us every day, and renders a long march impossible; but, being anxious for a correct measurement of the distance to the boundary, I shall take the odometer through. The mountains now trend to the east of north, but appear to terminate that course at a conical peak distant about twenty-five miles. In four miles came to a small spring-brook, which is the most southerly headwaters of the Teton river, and in ten miles more reached two beautiful creeks, which unite just below our crossing and flow through a deep valley towards the Teton. Passed over many steep hills, and the country to-day is more hilly, and travelling more difficult than on any previous day. Soil becoming more stony and sterile, and few flowers are seen, excepting in the little valleys of the numerous spring-brooks, where there are rich grass and many flowers; most of which, however, have already been collected. In sixteen miles crossed another fine creek, sixteen feet wide, which I named "Beaver-Dam creek," on account of the numerous beaver-dams in it. In three miles more we saw on the right hand, far below us on the plain, a considerable creek, which empties into the Teton nine miles from the mountains. There is no timber upon its banks, which are densely overgrown with thickets of birch and willow bushes. In twenty-one and a half miles struck the Teton river, which here runs due east. The river spreads into several channels, running with a swift and shallow current through a level plain almost destitute of grass, the soil of which is composed of small stones and gravel as in the river-bed. There is but little timber, which is dwarf cotton-wood and willow. The river forks just above our camp, and enters the mountains through narrow gorges, affording no valley or pass whatever. The blue peaks of the Highwood mountains were visible from a butte near camp, and I took bearings, as also on Heart mountain.

May 20.—Morning oppressively warm. The country we are passing over is a stony plain, intersected by numerous spring-brooks running through deep, narrow valleys, in which the soil is good. Tracts thickly wooded with scrub-pine, and many marshes or quagmires in the valleys, rendered travelling slow and laborious. Considerable snow was seen low down on the mountains, and some even in the valleys. Specimen No. 66, a beautiful bell-shaped flower of a golden yellow, was found by the side of a snow-bank six feet deep. Continued a course along the base of the mountains, which now trend to the northwest, are more detached, and descend to the plain by a succession of hills densely timbered with pine of a fair size. Many of the peaks, however, still preserved their rugged character, having perpendicular rock after reaching within three hundred feet of their summits, rendering it impossible to ascend them from this side. In the afternoon the Highwood mountains were still visible, and I took bearings. The "Three Buttes" are just discernible in the northeast. Saw two grizzly bears digging roots. They are very poor at this season, and their skins are worthless. These bears were very timid, and ran off when we were within half a mile of them. This is generally, if not invariably, the case with the grizzly bear when in the plains. They are dangerous only when wounded, or come upon unexpectedly in a thicket. In the afternoon crossed many small brooks, which are doubtless the headwaters of Birch river—a large fork of the Marias river—which I hoped to reach to-night; but finding it impossible, encamped on one of its forks at the foot of a lofty peak of the mountain. The country has been improving for the last fifteen miles, and this creek runs through a rich valley wooded with small poplars, and possessing a more luxuriant vegetation than I have yet seen. Collected seven new varieties of flowers. Ascended a lofty spur of the mountain, and found its summit to consist of granite and soft, red sandstone. Had a heavy thunder-storm in the evening; previous to which I heard a noise in the mountains like the discharge of artillery, resembling the reports and explosions mentioned by Lewis and Clark and others. I have noticed this phenomenon several times, and conclude that it is occasioned by distant thunder-storms, either in the mountains or beyond the dividing ridge. Made to day 21.3 miles.

May 21.—Moved early, and, after passing many small brooks and lakes, or ponds, struck Birch river just below where it issues from the mountain. Three miles after entering the defile, the river forks in two streams of nearly the same size. There is probably no pass here, as there are no signs of a road or trail, and the river evidently does not head far up in the mountains, which are lofty and very rugged, and then slopes densely timbered with fir. On the summit of a high range of hills next the river I collected in little grassy openings among the pines, eight new flowers, and in the valley four more. Each specimen has been carefully numbered and labelled with a description of place where found, color, &c. The soil here is rich, and the country generally better than any yet passed over. Birch river is timbered with cotton-wood, willow, and a great quantity of yellow or gray birch, from which it takes its name. This is the largest fork of

Marias river, and some years since was a favorite resort for the Assiniboins and Crows, who concealed themselves in the thickets and attacked small hunting parties of the Blackfeet. To-night we have no fresh meat, and there is only sufficient bacon for a day or two.

May 22.—Started early, hoping to reach the main stream of Marias river to-day. Road hard for the odometer wagon, on account of crossing so many small streams bordered by thickets of willow and small poplar. Passed many small lakes from one to twenty acres in extent, clear and deep. In fourteen miles came to Badger creek, a rapid stream fifty feet wide, and fordable with difficulty. This is also a fork of Marias river. In three miles more crossed a beautiful little stream, well timbered with large cotton-wood, and I name it "Cotton-wood fork." Continue to pass many small lakes. The country is now becoming rich and beautiful, and the grasss so luxuriant as to form a heavy turf. The soil is dark loam.

Saw three elk and a doe moose, and killed her fawn, the skin of which I preserved. At 6 p. m. reached the main stream of Marias river, or, as it is called by the Blackfeet, Kay-i-you, or Bear river. Character of the stream much the same as lower down near Fort Benton; valley narrow and at least four hundred feet below the plain, which is intersected by tremendous coulées running back a mile or two from the river. Descending a very steep hill, found that we had struck the river just below where a large fork comes in on the opposite side. The river is high, and the current very swift. After selecting the best place to ford I endeavored to cross, but my horse lost his footing, and was carried down stream with great velocity. It was impossible to turn back, and we came very near drowning, but finally reached the opposite shore without damage save the wetting of my field and note books.

It was impossible for my party to cross in the present stages of water, and I determined to go higher up on the mountains. It was necessary, however, to return to my party, and I accomplished this by fastening gun, coat, &c., on my horse, and driving him over, when I swam across myself. Encamped on the upper end of the point among a few willows, there being no timber here. Had a heavy thunder-storm in the evening, and the rain fell in torrents. Made to-day 22 miles.

May 23.—Morning cloudy and cold. The rain of last night raised the river 18 inches. Pursued a southwest course up the river, passing over high hills and through fertile valleys, in which were many small lakes and groves of tall pines. In six and a half miles farther, progress up the stream was prevented by dense pine woods. An old Indian trail afforded an easy road to the river; and, descending three terraces or plateaux, we found ourselves on a level with the water, in a bottom of some thirty acres in extent, among tall cotton-wood and poplars, of a scattering growth, and most luxuriant grass. Wishing to determine the latitude of this point and collect specimens, I shall encamp here for one or two days. Despatched Monroe to hunt, and the men to fish, and went myself to collect specimens. A few new flowers were obtained, but the majority of those seen are the same as previously collected. No game was killed, but the men caught several dozen of fine brook trout, many of them being eighteen inches in length.

May 24.—Morning clear and warm. The Marias river comes through a gap in the mountains some fifteen miles in width. The country is hilly and densely timbered with pine, but the soil is rich even on the highest hills. There are, however, many grassy openings or small prairies, from one to ten acres in extent. From a peak of the mountains next below the highest range I obtained a good view of the course of the river, and found that it runs northeast, whilst Mr. Tinkham's survey makes its course *south*-east. His description and topography of the pass and mountains do not agree with the reality, and it would certainly seem as though he could not have passed through here. Farther, directly up the main stream, is impracticable; but this wide depression, and no mountains to be seen in the west, would seem to indicate the existence of a favorable pass on some one of its branches.

A sextant observation at noon gives for the latitude of our camp 48° 20′ 59″, which is more than twenty miles south of the location given this river by Mr Tinkham. No game was killed to-day, but we have an abundant supply of trout.

May 25.—This morning found that the horses had taken a stampede, and crossed the river in the night; and, as none of my men can swim, I am compelled to cross the river myself and bring them back. In returning they evinced much sagacity in selecting a place where it was just possible to ford. Packed up, crossed safely, and, passing over a high level prairie, in two and a quarter miles were brought to a stand by the large fork noticed as coming in at our first camp on the Marias.

This stream here, and below to its mouth, is completely hemmed in by banks of perpendicular rock, from 100 to 300 feet in height, and is, at this stage of water, swift and deep. Found it impossible to cross, or even to get down to it with the pack-animals. I therefore directed my men to encamp at a small lake surrounded by groves of poplars, while I took Monroe and went up the river to find a ford. Passing through dense pine woods for three miles, came to where this branch forks. The left-hand fork flows through a fine valley, and no mountains are visible in the west. This is the proper route through the Marias Pass, as is evidenced by the fact that an old lodge trail passes up this branch, and it must have been considerably used by the Kootenaies and Flatheads thirty or fifty years since. This spot was also once a favorite camping and hunting ground of the Blackfeet; but they seldom visit it now—perhaps no more than a dozen lodges in the course of a year, for the purpose of hunting elk and moose. The pass is seldom or never used by the Blackfeet. My interpreter informs me that the Indian who came as Mr. Tinkham's guide from St. Mary's said, that after reaching Fort Benton they came through the pass at Cut Bank river, a branch of the Marias twenty-five miles north of this, and thus my conjectures that Mr. T. could never have seen the Marias Pass are confirmed.

May 26.—Killed two geese this morning; and they are in good time, as we are destitute of meat. Passed up this stream, which I have named "Rocky fork," and crossed it just above a cascade of ten feet. Our course then lay over a rolling prairie, with many small lakes surrounded by poplar thickets. Soil, rich loam. Crossed another fine creek, and in seven miles came to another large fork, too deep to ford where we struck it. Travelled up the stream, following an old Indian road cut out through a dense pine forest, which led to a tolerable ford.

At 1*h*. 40*m*. p. m. there was a total eclipse of the sun, which terminated at 3*h*. 20*m*. p. m. Encamped at the river crossing.

May 27.—Last night there was a heavy frost, and the morning is cold. Our course lay close to the base of the mountains, which are becoming more rugged in character, loftier, and covered with snow three hundred feet below their summits. The country is considerably broken by high hills and narrow valleys of spring-brooks filled with thickets of poplar and willow, and flooded by beaver dams. In twelve miles came to a fine stream, which is a branch of Cut Bank river; and in sixteen miles reached the Cut Bank itself, the most northerly fork of Marias river. It is a rapid stream, fifty feet wide, and flows through a rich valley. Its banks are of yellow clay and marl, in some places perpendicular, but generally low and sloping. Upon the headwaters of this stream is the pass through which Mr. Tinkham came from St. Mary's, and his report renders any further examination unnecessary. A broad lodge trail leads up the valley, indicating that the pass is considerably used—probably by the Pend d'Oreilles and Kootenaies, who come through to hunt buffalo. Crossed at a good ford; pushed on over a range of high hills, and encamped on a small stream, eight miles from Cut Bank river, and which is no doubt one of the sources of Milk river. A cold northwest wind blew violently during the afternoon, and it is snowing in the mountains.

May 28.—Morning cold, and the hills are white with snow. The country is quite flat, and full of springs and spring-brooks, which are the sources of Milk river. On our left is a heavy forest of pine timber fifteen miles in length, and extending into the plain eight miles from the base of the mountains. Immediately after passing this point, we obtained a view of the chief of King mountain, which is a bare rocky peak of a square form, standing at a distance of five or six miles from the main chain, and connected with it by a high ridge wooded with pine. In seventeen miles came to a broad valley, the sides of which are wooded with pine and poplar; and in the bottom, five hundred feet below us, we saw the blue water of a mountain lake. This is the well-known Chief Mountain lake. It takes its name from the Chief mountain, so called in honor of Mr. Roan, a gentleman who has been many years in charge of Edmonton House, a Hudson's Bay Company's post on the south fork of the Saskatchawan river. Descending into the valley, in four miles we reached the lake, and encamped in a beautiful prairie bordering it.

May 29.—Moved up the lake three miles to its inlet, and encamped. In this camp we remained until June 5th, having been so unwell during that time as to be unable to travel, or do more than make short explorations and observe for latitude.

Chief Mountain lake is seven miles long by one broad. Its banks are low and shore gravelly; the water clear and very deep. The valley of the lake is six miles in breadth, and is rolling-prairie, interspersed with groves of cotton-wood and poplar, and in the low places the birch and willow. The soil is a reddish loam, and is fertile, as is indicated by the luxuriant vegetation. Pine of a fair size and thrifty growth is abundant, and can easily be obtained; and there are inexhaustible quarries of good limestone.

Connected with Chief Mountain lake is another, three-fourths of a mile wide, and extending nine miles into the mountains in the form of a bow, and I therefore called it "Bow lake." It is shut in by mountains coming close down to the water, and has no valley susceptible of cultivation.

The mean of observations for latitude gives as the latitude of this, the south end of Chief Mountain lake, 48° 43′ 07″, or 17 miles south of the boundary line. The British traders on the Saskatchawan have always contended that the boundary line was as far south as the Marias or the Cut Bank river; but my survey shows that Chief Mountain lake and its environs, as well as the tract of fertile country extending south to the Marias Pass, belong to the United States.

Several lodges and numerous signs of Indians were seen in this vicinity, and I presume they were made by Kootenaies who come here stealthily to hunt. It was at first supposed that there must be a good pass in this vicinity, but a close examination satisfied me that such is not the case.

Numerous little streams emptying into these lakes are filled with beaver dams and beaver, this industrious animal having been left in quiet possession of this country since the low price of its fur has rendered it unprofitable to trap them. Elk, moose, and deer are abundant, and salmon-trout of a large size are taken in the lakes.

June 5.—Started due north along the lake shore, and in seven miles came to the outlet at the extreme northern end. The outlet is called in the Blackfoot language Mo-ko-un, or Belly river. It is a swift, deep stream, where it comes from the lake, and about 80 feet wide, and its course for some miles is due north. This is the most southerly of the headwaters of the Saskatchawan river. After receiving the waters of the "Bad Buck Fat," the Bear's Pound, and the Bull Pound rivers, it empties into Bow river, which joins the Red Deer or Elk river, and their junction forms the south branch of the Saskatchawan. The valley of Mo-ko-un river is here three miles in width, stony and sterile. High hills bound the valley on either side, and the country generally is broken. Passed one large fork rising near Chief mountain.

The next day continued down the stream on the east side, passing two large forks coming in on the north. The country is becoming less broken and the soil richer. There is very little timber on the river, and it is principally cotton-wood and poplar. We made to-day about 25 miles, and encamped where the wooded points cease.

June 7.—Remained in camp to observe for latitude and explore the country. In riding down the river 15 miles, found no timber, and there seems to be here a stretch of at least 50 miles destitute of wood. Far to the north and east stretches a vast plain, or, more properly speaking, a prairie; for in richness of soil, luxuriant vegetation, and bright-colored flowers, it greatly resembles the prairies of the Western States.

On the 8th we started on the return trip, striking for the Cut Bank river, but taking a course farther from the mountains than when coming up. Crossed five fine creeks which are the sources of Milk river, and are formed by the spring-brooks we crossed near the base of the mountain. Noticed several ridges of soft sandstone in the plain, running for several miles north and south, with a nearly vertical dip, and resembling generally the roof of a house. Many antelopes, elk, and deer were seen, and I killed enough to supply my party with meat.

On the 9th, left Cut Bank river and pursued the same route by which we came up, this being in fact the only route where the stream can be crossed in high water. Observed to-day great quantities of the camash, now in full bloom. It is a beautiful dark-blue flower, bell-shaped, and growing single on a stem ten to fifteen inches high. The camash is particularly abundant in the vicinity of Marias river, near the mountain. Crossed Clear fork, Middle fork, and Fall fork, and encamped on the latter at the Cascade.

The next day was devoted to making further explorations of this pass. Following the old lodge trail, now no more than a narrow foot-path—although the decayed stumps and trunks of trees clearly indicated that a broad road had once been cleared—in two miles found that the stream forked: keeping the left-hand branch, came in six miles to where it forks in many branches, all heading in rugged mountains on the right hand, or northwest. Pursuing from this point a course due south, magnetic, or south 19° W. true, in 20 miles struck the main stream of Marias river, which is still a considerable stream, running in a defile or ravine 500 feet in width, and having banks of perpendicular limestone and sandstone rock; the bed of the stream being of the same material in huge fragments, and breaking the water into a continuous rapid. The trail continues up the river, sometimes over hills of moderate elevation, densely timbered with the narrow-leaved pine, and at others through small openings or prairies of rich soil, producing luxuriant bunch-grass and a great variety of flowers. At a distance of four miles more I ascended a lofty hill, from the summit of which I obtained a commanding view of the pass and the course of the river for a long distance tothe southwest.

The pass continued about fifteen miles in breadth; the country hilly and densely wooded with pine. The mountains on either hand are lofty and rugged, showing generally perpendicular rock from within 300 feet of their summits, and are covered with snow as in mid-winter. Snow-banks were also found on the north side of many hills in the pass. Up the pass to the southwest no mountains obstruct the view; and I am satisfied that Mr. Tinkham could not have passed over this trail, or he would not pronounce this portion of the pass so difficult as his report and topography represent it. This pass is not vouched for as a good railroad or pack-train route, yet it is believed worthy of further examination; and I only regret that I cannot make it, as your instructions require me to be at Fort Benton in the last days of this month. The trail which I followed continues up the valley, and a deserted encampment of last summer indicates that this pass is occasionally frequented by the Flatheads or the Kootenaies, for the purpose of hunting elk and deer, which are numerous here.

The day had been oppressively warm, and I returned to camp at sundown somewhat fatigued with a ride of sixty miles. One of the men had killed a deer, and we made a luxurious supper on venison and coffee.

June 11.—To-day being Sunday, we remained in camp. The sand-flies and mosquitoes were very numerous, and annoyed our animals so much that we were compelled to make smokes for them. Collected here thirty-five new varieties of flowers, and noticed a plant said to possess remarkable qualities. The leaves are five or eight in number, and closely resemble the leaf of the pumpkin vine in shape and size. The stalk rises to the height of three or four feet; is cylindrical and hollow. This stalk is eaten by the Indians, and is cooked by throwing it on the coals for a few moments, and in taste slightly resembles cabbage; in fact, the French and half-breed hunters call it "Des Chou," or cabbage. The roots of this plant are made into a poultice and applied in cases of bruises or chronic swellings, and are said to be very efficacious. From a description given me of the plant when at maturity, the seeds appear to be contained in a capsule, oblong in shape, and one inch in length; color, black; and size, that of the seed of the sweet pea. The seeds, when powdered, are used by the North Assiniboins and Cree Indians to poison bullets and arrows, and it is said that any animal wounded by an arrow so poisoned will die within an hour. The day was oppressively warm until 5 p. m., when it commenced raining, and continued until 9 p. m.

June 12.—Morning clear and warm; started early, and passed down Fall fork to Goose lake; thence to Marias river at our former ford, where we crossed without difficulty; thence, following an old Indian road that must have been cut through the forest at the time the Snake Indians inhabited this country, we passed over and along the first ridge of the mountain, or in the plain at its base. Observed during the day many small lakes and spring-brooks. The soil is excellent, producing an abundance of good grass and numberless flowers. The mountains here turned southwest and northeast, and, where terminating on the plain, they seem to have been cut off perpendicularly, and the granite and limestone composing them are scattered in huge fragments over the plains at their base. Pine of uniform size grows upon the sides of these ranges as far up as an elevation of 1,000 feet, whence to their summits is nought save naked rocks and banks of snow. Passed Badger river at 1 p. m. During the afternoon there were several showers of rain; but pushing on, we reached Gray Birch river at half-past 6 p. m. Crossed and encamped, having made to-day 29 miles. It rained heavily during the night.

June 13.—Morning clear and warm. We made an early start, taking a course farther from the mountains than where we came up. Crossed during the day three fine creeks running through rich valleys, but destitute of wood. The country is now a vast plain, descending towards the east. As we pushed on, the soil was evidently becoming of inferior quality, and the dry, mullen-leaved flowers indicated our near approach to the high dry plain extending to the Missouri. There were heavy showers in the mountains all day. Two passed near, giving us a few drops of rain and terrific thunder and lightning. In 24 miles from our camp of last night we reached the level stony valley of the Teton river, and soon after a severe storm of rain and hail burst upon us. The rain fell in torrents, and the plain was covered with water to the depth of four inches. In four miles more we struck the Teton, and crossed it. It was with great difficulty we could find a spot on which to encamp not overflowed with water; but at last pitched the tent upon a small knoll thickly carpeted with Ura Ursi, or the smoking-weed. The timber at this point—principally the cotton-wood—has all been killed by fire; and the blackened trunks and dead branches, seen through the driving sleet and mist; the tired mules crouching here and there under some bush to avoid the pelting hail; ourselves wet completely; the difficulty of making a fire;—all combined, was a sufficiently desolate prospect to make this scene the most cheerless encampment of the whole trip. The rain ceased at 10 p. m. Made to-day 28 miles.

June 14.—To-day we remained in camp to dry the packs drenched by last night's rain. Walking down the river a few miles, I collected twenty-four new varieties of flowers. The land is of no use for farming purposes, and the yearly fire will soon consume every stick of wood. Three miles below our encampment, and four from the river, is a hill some two hundred feet high, perfectly resembling a woman's breast; and it is from this hill, which can be seen at a long distance, that the name of this river is derived, the Blackfeet calling it Mone-e-kis, or Breast river. From the hills near camp, the buttes called "the Knees" show a faint outline of blue.

June 15.—Started early, travelling down the river, which pursues a very sinuous course, winding from side to side of a broad valley bounded by low hills. There having been no fires here for several years, heavy points of cotton-wood are seen along the stream, and the grass in the bottoms is luxuriant. The soil appears to be rich, and this is probably a good locality for farms. Saw numbers of deer of the white-tailed species, and one of the men killed one.

Heavy rains have fallen here lately, and rendered the ground in some places very soft. Passed two considerable forks coming in on the opposite or north side of the river; one of them is called the Miry fork, and differs from the other streams in this region in having a muddy bottom, rendering it very difficult to ford. At 2 p. m. crossed a large, rapid, gravel-bottomed fork, coming in from the southwest, which must be formed by the two creeks nearest Sun river, crossed by us on the 19th May. Collected a specimen of the large crimson-colored prairie lilly, common to the western prairies. It stood alone, and after a careful search I could not find another. This familiar flower reminded me forcibly of home. Several deer were killed during the day, and we now have some fresh meat to carry to the fort, in addition to four bales of dried meat, made at Chief Mountain lake.

Noticed to-day the first prickly pear since leaving Sun river, on May 19th. None of this plant is found along the mountains, where the soil is fertile. Thickets of the black cherry and service berry bushes were seen along the river, and their fruit has now attained half of its size at maturity. A heavy rain coming on, we encamped early, in a fine point of timber, having made to-day 23 miles.

June 16.—It rained all night, and continues this morning. The river valley is narrow, and timber scarce. The plain above the valley is higher, and the soil of poorer quality. In eight miles the river makes a great bend to the north, and we made a cut-off, crossing several bad coulées; following down a coulée, struck the river again where the valley widens, and there is plenty of wood. We now travel in the bottoms, crossing the points of the hills where they come to the river. Grass continues luxuriant in the bottoms, and the whole course of the river affords the finest grazing ground. We encamped early; it commenced raining soon after, and continued until sundown.

June 17.—Continued down the river; its character and that of the country continuing quite the same as yesterday. In twenty miles reached the "Big Bend," where the river makes a long detour to the north. Took the cut-off, following a broad lodge trail, over a high table-land, and in six miles struck the river again. In three miles more we encamped in a fine grove of timber, near a thicket of rose-bushes, where millions of their blossoms perfumed the air. In many places the plain was covered with the large and beautiful blossom of the prickly pear; it is of a delicate straw-color, veined with crimson and purple, and centre of deep chocolate-color. Also noticed a few blossoms of the small round pear, which grows under ground, showing no more than the crown and blossom above, which is of a deep scarlet color, of the size and form of the scarlet geranium.

June 18.—Morning oppressively warm. Continued down the river, keeping generally on the plain, and crossing many difficult coulées, rendering the road fatiguing to the animals. Nothing occurred during the day worth noting. Struck the river again at 4 p. m., and encamped in a fine point of timber, opposite the buttes called "the Knees," and distant fifteen miles.

June 19.—Made an early start, taking the lodge trail leading directly to Fort Benton. At 1 p. m. reached camp Dobbin, and at 3 p. m. came in sight of the Missouri river, near Forts Benton and Campbell, with a number of Blackfeet lodges around them, and multitudes of horses grazing in the bottom. The Missouri, now full nearly to the level of its banks, appears a mighty stream in comparison with the little rivers we have crossed. Pushed on, and were soon within the walls of Fort Benton, and received a warm welcome from Mr. Rose, the gentleman in charge.

Found all well at the fort, and the government horses and mules in fine condition. They have had nearly a famine at the fort since we left: no coffee, tea, sugar, nor flour; and their hunters having been too lazy to procure meat, they had been compelled to eat dogs.

Having unpacked the mules, turned them out to graze, and had the packs, specimens, &c. safely stored, I retired once more to my old room, and after an absence of forty-one days in the plains and mountains, it seemed to me quite like home.

The general results of this reconnaissance have been, a thorough exploration of the country from the Missouri, along the base of the Rocky mountains, to the parallel of 49° 30′, carrying a correct odometer measurement to the boundary; discovering the sources of Sun river, Breast river, Marias river, Milk river, and their branches, and also Mo-ka-un or Belly river of the north, and their general characteristics; ascertaining the existence of a large body of agricultural land, and proper localities for farms, and the general capabilities of the country for settlement, and collecting specimens in geology, natural history, and botany. Three hundred and twenty varieties of flowers—many of which, it is believed, are new to the botanist—were collected and carefully preserved, each specimen having a label attached, stating place where found, color, &c. The barometrical observations were continued as far as Badger river, where the barometer was, most unfortunately, broken, thus destroying my hopes of obtaining a correct barometrical profile of the country.

Some knowledge also was obtained of the Marias Pass, showing that its character is entirely different from what had been previously supposed.

It was practically demonstrated that a party of four white men *can* travel for forty-one days in the heart of the Blackfoot country, without losing either horses or scalps.

And finally, by odometer measurement and sextant observations, it is believed a tolerably correct map has been made of a country hitherto unexplored.

All of which is respectfully submitted; and I have the honor to remain, respectfully, your most obedient,

JAMES DOTY.

Governor I. I. STEVENS,
In Charge of N. P. Railroad Survey.

REPORT OF MR. JAMES DOTY, OF A RECONNAISSANCE FROM FORT BENTON TO CANTONMENT STEVENS, AND OF A SURVEY FROM FORT BENTON TO OLYMPIA.

OLYMPIA, W. T., *January* 1, 1855.

SIR: Having submitted to you reports upon the Blackfeet Indians, the navigability of the Missouri, and a reconnaissance from Fort Benton to the parallel of 49° 30′ N., I now have the honor to submit a brief report of a reconnaissance to Cantonment Stevens in July last, and of my survey from Fort Benton to Olympia, in September and October.

After returning from my northern tour on the 19th June, I remained at my post until July 8. On the 4th of July an express arrived from Lieutenant Mullan, bringing me your letters of April 1, directing me to remain at Fort Benton until further orders. Deeming it my duty in the meantime to make all the explorations in my power, I determined to visit Lieutenant Mullan in the Bitter Root valley; and accordingly, on July 8, accompanied by Mr. Burr, who had brought the express, and two of my men, I left Fort Benton; and passing over the usual route, encamped at the Great falls of the Missouri. Thence to within ten miles of the divide of the Rocky mountains, our route was the same as that of the main train in September, 1853. At this point our course, which had been nearly south, turned due west, and, following up the valley of a small creek now dry, by a well-worn Indian trail, in eleven miles crossed the divide, which is merely a hill about five hundred feet high, and fell upon the waters of the Columbia; continued down this creek a short distance, when, leaving it to our left, crossed a tract of rolling prairie and pine openings, and entered a beautiful prairie bordering a large creek, which is supposed to be the main stream of the Blackfoot fork, and down which we travelled. At the end of the prairie struck the trail of the main train, and, following it, encamped at the crossing of the river.

July 12.—Continued down the river, meeting nothing worthy of notice, and encamped at the crossing of Salmon Trout river, near its junction with the Blackfoot.

July 13.—Followed the main trail for 15 miles, when, leaving it, took the Camash Prairie cut-off. The trail turns to the south, and in six miles crosses the Blackfoot, and, passing through open pine woods for five miles, comes out upon a beautiful prairie, having a rich soil of black loam, and covered with luxuriant grass. The prairie, which is about four by ten miles in extent, is the

Camash prairie of the Flatheads; and here they resort in early summer to dig their favorite root, which is produced in the greatest abundance. Crossing the prairie, and passing through some scattering pines, reached a small prairie, through which ran a spring-brook, and here we encamped.

July 14.—Passing through pines of a large size and scattering growth, at 3. p. m. struck the Blackfoot again, and crossed at a shallow ford. This cut-off which we have made affords a very good road, and is said to avoid some very bad side-hill travelling on the main trail along the Blackfoot. At 4 p. m. passed the junction of the Blackfoot with the Hell Gate; and at 6 p. m. crossed the Hell Gate at its upper ford in the Bitter Root valley, and encamped.

July 15.—Started very early, and, passing up the Bitter Root river by the high-water trail, leading in some places along a very steep side-hill road, at 2 p. m. reached Fort Owen, a trading post owned by Mr. John Owen, who had started for Oregon yesterday. Pushed on up the valley over an excellent road, and at 4 p. m. reached Cantonment Stevens, where I received a most cordial welcome from Lieutenant Mullan. We were not sorry to find so comfortable a resting-place, after travelling 256 miles in eight days across the mountains.

July 16, 17, 18, 19, *and* 20.—Remained at the Cantonment, enjoying myself much in the society of Messrs. Mullan and Burr, to whom I am indebted for five of the pleasantest days I have passed since leaving the Mississippi river. This beautiful valley seems almost a Paradise, in its strong contrast with the brown and desolate plains to which my eye has been so long accustomed. Its hills, meadows, and woods, clothed in the vivid green of midsummer, kept ever fresh and verdant by timely showers and mountain dews, and watered by the clear mountain stream rushing through the valley, were exceedingly beautiful, and made it indeed a charming spot to look upon.

A particular description of this valley is not deemed necessary, as Lieutenant Mullan will report fully thereon; but it is proper to remark that, in my opinion, this is a most excellent locality for farms and for grazing. Its rich soil, luxuriant grass, and abundance of wood, water, timber, and stone, render it in all respects a desirable location, and when brought fully to the notice of emigrants, will no doubt be speedily populated.

From Lieutenant Mullan, although his supplies were limited, rations were obtained for my party till September 1, and I take this opportunity of expressing my appreciation of his kindness.

July 21.—Moved from the Cantonment, accompanied by Lieutenant Mullan, and encamped at the Cold spring, six miles from the upper crossing of Hell Gate. Here a portion of the Flatheads were encamped; but there being no interpreter, a "talk" was not held with them.

July 22.—Moved early, crossing Hell Gate at our former ford, and the Big Blackfoot near its mouth, and followed up the Hell Gate by Lieutenant Mullan's wagon route. The valley of the river is narrow, and somewhat thickly timbered with cotton-wood, willow, and pine, but by occasionally crossing the stream, a good wagon road is found at low water. The high-water trail along the side-hill is not so favorable for a pack-train as that on the Big Blackfoot. In the afternoon we overtook a party of thirty Blackfeet, men, women, and children, who were returning from a visit to the Flatheads. They expressed a desire to join my party, and accordingly we travelled on in company. The road during the day continued good, and we encamped at sundown in a fine meadow on the main stream, at the fifth crossing, and estimated thirty-five miles from the Cold spring. Just as we encamped, Gabrielle, Lieutenant Mullan's interpreter, and twenty Flatheads, rode up, bringing me a note from Lieutenant M., saying that seven horses had been stolen from the Flathead camp, and these Indians were in pursuit of them; he wished me to do all in my power to recover them. Gabrielle and the Indians, instead of pushing on, as they should have done, encamped near us, and passed the night in gambling.

July 23.—Morning clear and warm. Gabrielle and the Indians, who had gambled all night, slept late, and they were still at the camp when we left. Continued up the river, making seven crossings, and avoiding two by taking the side-hill. After crossing three small creeks, came to another; when, leaving the Hell Gate, we followed up this small stream, and halted at noon at the foot of the divide between Flint creek and the Hell Gate.

This divide is mainly a high-rolling prairie, the hills attaining an elevation of 300 to 500 feet, and the ascent is so gradual as to afford a first-rate wagon road, and the descent is the same. Soon after reaching the foot of the divide, we crossed Flint creek, a considerable fork of the Hell Gate, and encamped soon after striking the river again.

July 24.—Continued up the river through a fine broad valley, affording luxuriant grass, and an abundance of wood along the river. Crossed the stream once, and avoided the remaining crossings by taking the side-hill trail. The valley still affords a good wagon road. About noon reached the mouth of the Little Blackfoot, up which stream we turned our course, leaving the Hell Gate on our right, and encamped at sundown on the Little Blackfoot, four miles above Lieutenant Mullan's camp of March 25.

July 25.—Continued up the river, on a course nearly due west, ten miles, then northwest four miles; when we left the stream, and passing over a fine prairie, course due west, in four miles reached the summit of the divide. The ascent is very gradual, and affords a capital wagon road. The descent was steep, but we had mistaken the trail, and two miles north of this there is a good road.

Following generally the route taken by Lieut. Mullan, crossed three small creeks, and encamped on the north branch of Prickly Pear creek, having found a good wagon road to this point.

July 26.—Continued on a course nearly north, and in four miles struck another creek, travelled down three miles, and struck Small Prickly Pear creek; leaving this, and passing over a hilly country, sparsely timbered with pine, and somewhat difficult for wagons, struck a fine prairie, through which passes a broad, large trail leading towards the Missouri. Crossing this prairie we struck another creek, and then passed across a high hilly country to a mountainous ridge, through which we took the pass called by the Blackfeet Nah-too-see-o-ko-toke, or Medicine Rock Pass. Thence the trail passed over high hills composed of loose decomposed slate and sandstone, and making a somewhat difficult road. In ten miles from the Medicine Rock we reached a fine bold creek twenty feet wide, called by the Blackfeet Assiniboin river, from the circumstance that several Assiniboins were killed here several years since. Its valley is narrow, but affords a tolerable road. Two miles above where we struck it, the river forks. Took the southern branch, and passing up three miles, encamped, having made 30 miles.

July 27.—Here we left this stream, taking a course due north, and in three miles crossed another creek, and following down one mile, came to a broad plain stretching towards the Missouri. Passing over a high prairie-ridge bounding the plain on the north, in four miles more struck a small branch of Dearborn river, now nearly dry, and in eight miles more came to Dearborn river itself. Here we nooned. The day was oppressively warm, as indeed have been all the days since we left Fort Benton. Continued on over a rolling prairie, crossed Beaver creek, passed between the three peaks, and encamped after sundown on Crown Butte creek, near Bird Tail Rock, having made a fatiguing day's march of forty miles. We are now in the trail of the main train, and of course there is a good road to Fort Benton.

Lieutenant Mullan's wagon route from this point to the St. Mary's valley is practicable, in my opinion, for wagons moderately loaded, and, with a small expenditure of labor, may be made an excellent road.

July 28.—Continued on over the same trail by which we came, and therefore it needs no description.

In climbing to the top of the butte called Crown Butte, I fell, and bruised my hand so badly as to deprive me of its use.

Pushed on, crossed Sun river, and encamped five miles below.

The next day my hand and arm were very much swollen, and so painful that I could scarcely ride. However, we reached the falls, and pitched the tent in our old encamping ground.

July 30.—At an early hour we pushed on for Fort Benton, where we arrived at 2 p. m., terminating a reconnaissance of 552 miles in seventeen travelling days, crossing the mountains twice. In fact, not a day was lost on the march, the only delay being five days at Cantonment Stevens.

The government property at the fort was found to be all safe and in good order.

From this time until August 16, my hand continued so lame as to prevent me from writing a word. On that day I started down the Missouri to make an exploration, and meet the American Fur Company's boats.

Upon this reconnaissance I have already had the honor to report, under date of December.

On the day of my return to my post, Mr. Burr arrived there with an express from Lieutenant Mullan, bringing me your instructions of June 2, 1854, directing me to proceed to Olympia, Puget sound, by way of Lewis and Clark's Pass, the St. Mary's valley, Cœur d'Alene mission, Wallah-Wallah, and the Snoqualme Pass.

In accordance with your instructions, receipts in duplicate were taken from the American Fur Company for all the government property in my charge which it was necessary to leave at Fort Benton—the property having previously been securely stored.

By your directions, the standard barometers, thermometers, and hygrometers were left at the post; and Mr. J. C. Tevis, a gentleman from St. Louis, coming up in the American Fur Company's boats, to spend the winter at Fort Benton, was solicited by ——— to take charge of the observations; and I have no doubt he will take pleasure in complying with the request.

On Thursday, September 7, although a slight rain was falling, and there was every appearance of bad weather, we packed up, and made every preparation to start, taking, by your directions, only such articles as would be necessary in making the reconnaissance to Olympia.

All the government horses and mules, and two yoke of oxen, for the use of the special agent in the Bitter Root valley, were included in my train.

At 11 a. m. we left Fort Benton, taking a course up the Teton river, proceeding very slowly, on account of the oxen, which were so fat as to be scarcely able to travel. About sundown, when we had made fourteen miles, one of the oxen was reported as unable to proceed farther, and I ordered one of the men to return with him to Fort Benton, and bring another ox in his place.

When we had proceeded some two miles more another ox gave out, and it was plain that the animals were too heavy with fat to endure the trip across the mountains, and I was reluctantly compelled to send them back to the fort, taking receipts for them from Mr. Alexander Rose, the gentleman in charge of the American Fur Company's establishment. At dark we encamped on the Teton, twenty miles from Fort Benton. My guide, a Blackfoot Indian, left my party to-day, and returned to his camp, and I was compelled to send for another.

The next morning, September 8, we continued up the river, over the same route explored by me on the 17th, 18th, and 19th of June. The two barometers which I have taken for field-work are, unfortunately, unreliable. One is a syphon, with the attached thermometer broken, and the other a closed cistern, which cannot be packed sufficiently tight to prevent it from leaking. I shall, however, take observations with both instruments, until it is proved that they are worthless. Made to-day 20 miles.

September 9.—Continued up the river, following an old lodge trail which crossed the stream frequently. Fire has lately passed over the country, and it is difficult to find an encamping ground affording sufficient grass for the animals. At 4 p. m. we reached a point where there is no timber on the river for fifteen miles in advance, and here we encamped, having made only 20 miles. A cold rain commenced from the northeast at sundown, and continued until 10 p. m.

September 10.—It is raining heavily this morning, with a northeast wind. A horse and a mule strayed in the night, and could not be found until afternoon.

A very vicious mule, which the men were endeavoring to pack, threw itself, while tied to a tree, and broke its neck. It was almost a worthless animal, being so vicious that it had never been packed. We started in the rain; and it being too late to make the crossing to Sun river, we continued up the Teton, and encamped, at 5 p. m., at the commencement of the great northern bend of the river. Mr. Burr, who left the train in the afternoon to hunt, did not overtake us, and we fired signal-guns during the night, to guide him to our encampment.

September 11.—Mr. Burr did not reach camp last night; and becoming anxious for fear some accident might have befallen him, I started early to look for him, and also sending out the guide.

I returned just as the train was ready to start, and was much gratified to find Mr. Burr at the camp. He had lost sight of the party, and being unable to find the trail, had passed the night on the plains.

Taking a course S. 20° W., we passed over a rolling prairie, rising gradually towards Sun river, which we reached at 2 p. m., and crossed just below the forks, and six miles above where Mr. F. W. Lander crossed. From here our course was due south, taking us, in twelve miles, to the summit of the dividing ridge between Dearborn and Sun rivers. Pushing on at a rapid rate, we reached Dearborn river, near its debouche from the mountains, at dark. Our camp is eight miles above the encampment of the main train September 21, 1853. And here the river valley is narrow, and bounded by lofty hills, showing generally towards the river a formation of perpendicular sand and limestone rock. We succeeded, after some difficulty, in getting down to the river, and found a good encamping ground. The country from Sun river to this point, a distance of twenty-four miles, is not favorable for a railroad. The highest points are about 1,500 feet above the valley of Sun river; and the numerous ravines and narrow valleys heading in the mountains and extending some distance into the plain, all of which must be crossed, render the route far less favorable for a road than that taken by the main train—crossing Sun river near the Big Knee, and passing between that and Crown Butte—and which, in my opinion, is superior to any other route examined.

A route may be found passing north of the Big Knee or Sun river, and striking Dearborn river a few miles below our present camp. This would be the route in case it was thought necessary to locate the road some distance north of Fort Benton, crossing Marias river above the butte called the Goose's Nose. But it will be observed that the slight advantage gained in distance will not counterbalance the important advantage to be gained by adopting a line located very nearly upon the route of the main train. These are, first, that it connects with the head of navigation, at or near Forts Benton and Campbell, of the Missouri river, upon which materials for the construction of the road, and supplies, will necessarily be transported; secondly, it will be seen by a glance at the map, herewith submitted, that, adopting Lewis and Clark's Pass of the main chain of the Rocky mountains, touching the head of navigation on the Missouri, and passing as near as practicable to the northern bend of the Missouri, immediately below the mouth of the Bear or Marias river, this is the shortest route; and, third, the nature of the country is such, that the difference in the cost of construction will more than counterbalance the extra distance to be travelled.

September 12.—Morning clear and cold, with a heavy frost. We started early, and held a course due south, along the base of the mountains, for eight miles, passing over a broken country similar to that described yesterday. The broad trail leading through Lewis and Clark's Pass had turned nearly due west, passing up a small creek, by a very gradual ascent, for one mile; then over a prairie of somewhat steeper slopes for half a mile, which brings us to the foot of the divide. This is a hill of steep ascent, of five hundred feet in elevation, sparsely wooded with scrub-pines.

The descent is for half a mile over a fine prairie slope, to the valley of a small creek, which is one of the headwaters of the Columbia river. The approach to this divide is very favorable for a railroad, and to pass the summit-level and connect the waters of the Missouri with those of the Columbia will require a tunnel not exceeding one mile in length. The course from the summit is west one mile to the small creek before mentioned, and then nearly south, down the valley eight miles, over a fine road, descending very gradually. This valley is a prairie from a quarter to half a mile wide, and wooded with open pines in small groves. Leaving this creek, the course is southwest, over a country thinly wooded with pines of a fair growth for three miles, to a fine prairie of a hundred acres in extent, in the centre of which is a beautiful small lake. Thence two miles through pine openings, when we reached a fine prairie, bordering a considerable fork of the Big Blackfoot, upon which stream we encamped, having made twenty-five miles from our encampment on Dearborn river. A very cold rain commenced at 9 a. m. this morning, and continued all day, rendering travelling very disagreeable. The night was too cloudy to observe for latitude.

September 13.—It was still raining heavily this morning, and upon some of the most elevated mountains snow fell during the night. At 9 a. m. we started down this fork, passing through a beautiful prairie half a mile in breadth, and in four miles struck the trail of the main train, which comes in on a course north 65° 30′ east; and in half a mile farther crossed the stream I have named "Lander's fork," and which I suppose to be the main fork of the Big Blackfoot river. After crossing, the trail continues down the river on a course south 68° 30′ west.

As, according to your instructions, my route from this point will be that taken by the main train, of which an accurate survey has already been made, it is not deemed necessary to run a compass line between this and the St. Mary's valley. We pushed on rapidly, and encamped at the edge of the large rolling prairie, a few rods below the encampment of the main train September 24 and 25, 1853.

September 14.—Last night was very cold, with a heavy frost, and ice made in a bucket of water an eighth of an inch thick. Passing over the high prairie, we obtained a good view of the valley of the Blackfoot, which is here some fifteen miles broad. The soil is good, timber is abundant, and I should think this a good locality for farms. The road during the day continued good, passing over prairies and through open pine woods. At 6 p. m. we encamped, having made to-day 30 miles.

September 15 *and* 16.—Continued on, and reached within five miles of Fort Owen. The next day, directing the men to come on slowly with the train, I started early for Cantonment Stevens, and reached it at 1 p. m., and was welcomed by Lieutenant Mullan, and also Mr. Adams, who came up from Olympia ten days since. Mr. Burr has concluded to remain in the employ of Mr. Adams, special Indian agent, during the winter.

September 18*th* was devoted to receiving and packing up sixty days' rations received from Lieutenant Mullan, exchanging receipts for animals, &c., and conferring upon the proper route to be taken in carrying in our parties.

In conformity with your instructions, it was my duty to proceed by the Cœur d'Alene mission, and Lieutenant Mullan determined to take a new route by the Lo-Lo fork, it being understood that our parties should rendezvous at Wallah-Wallah. I employed as guide a Spokane Indian who had come up with Mr. Adams from Wallah-Wallah.

September 19.—Left Cantonment Stevens, accompanied by Lieutenant Mullan. At Fort Owen, twelve miles from the Cantonment, we separated our band of animals, and Lieutenant Mullan pushed on and encamped beyond the first crossing of the St. Mary's river, while I encamped four miles this side.

September 20.—Started early, and at 9 o'clock passed Lieutenant Mullan's camp. He will be delayed a day or two by the loss of yesterday of a pack-mule, with his tent and mess equipage. Continuing down the St. Mary's, crossed Hell Gate, and, passing over a rolling prairie, encamped on the St. Mary's nine miles below, having made 35 miles.

September 21.—This morning the fog was so dense as to render it impossible to see in any direction fifty yards, and in consequence the horses could not be found until a late hour. Continuing down the river, the valley, which has heretofore been broad and level, at nine miles from the camp, narrows to half a mile in width, and is quite broken. In three miles more we crossed a creek eight yards wide, coming in from the northeast; and here the St. Mary's makes a sharp bend to the west and southwest, and runs through a rocky defile.

The trail passes over high hills on the north, but a railroad may be constructed on a narrow margin of level ground along the river.

Passing the hills, in four miles the road leads over a wooded table-land sixty feet above the river. The road continues good for twelve miles, when it passes over a ridge of basaltic rock abutting upon the river, which is here narrow and deep, running through a rocky defile.

In two miles farther we reached a fine bottom affording good grass, and here we encamped, having made 30 miles. In the last twenty miles of this day's march there is no agricultural land; the river valley being generally no more than three-fourths of a mile in width, and in many places the lofty mountains on either side come close to the water.

September 22.—We continued at an early hour down the stream, passing for eleven miles over a high plateau, wooded with an open and thrifty growth of yellow pine, when we reached a point where the mountains upon this side abut upon the river in perpendicular rock. The trail leads for six miles over these mountains, while upon the opposite side of the river is a fine wooded bottom practicable for a railroad. Leaving the mountains, we struck a high sandy plain, wooded with pine, and affording a good road; at 5 p. m., having found some grass not destroyed by the fire which has lately run over the country, we encamped, having made 25 miles.

September 23.—Started early and pushed on at a good rate over a fine road, the trail passing sometimes through narrow bottoms, and at others along the sides of the hills where they touch the river; at 2 p. m., having made fifteen miles, we reached the crossing of the St. Mary's river, and succeeded in fording it without damage save the wetting two or three packs.

This is a long and difficult ford, and not to be undertaken by any one not well acquainted with it.

At this point the trail leading to the Cœur d'Alene mission leaves the St. Mary's and passes up the small stream called by the Catholic missionaries St. Regis Borgia. My guide says that we must encamp here, as there is no water for some distance in advance.

The country in the vicinity of our camp is a densely-wooded level of rich soil. One mile below is a much better ford of the St. Mary's than the one we passed over. Several Kootenaies Indians visited camp during the evening; they are well formed Indians, of agreeable features and rather light complexion. They seemed very poor, and I gave them food, and some small articles, as tobacco, fish-hooks, &c.

September 24.—There was a heavy frost last night, and a dense fog this morning. Continuing our journey, we followed a trail leading along a high ridge densely timbered with pine, spruce, and fir, bounding on the north a narrow valley, and running nearly due east and west. In seven miles the trail crosses the valley and passes over a mountain for five miles, where was much fallen timber, and the road generally difficult; but it is evident, by cutting out the timber in the valley of the creek south of this trail, a good road can be found.

At the foot of the mountain we crossed two brooks running south, and in one mile more crossed a fine creek ten feet wide, running in the same direction; and in fifteen miles from the St. Mary's reached St. Borgia river, which is sixty feet wide and two feet deep, with a swift current flowing over a pebbly bottom, and the stream does not appear to be subject to heavy freshets. Following up on the north side for seven miles through small openings and timber of medium growth, chiefly pine, spruce, and hemlock, we encamped where the trail first crosses the river.

September 25.—It was raining heavy this morning, but we packed up and started, as I am determined to push ahead. The road crosses the stream frequently, and is altogether generally level—difficult for pack animals, on account of thickets of willow and fallen timber. The country continues the same as yesterday, occasional openings occurring, where is found good grass.

Passed several lodges of Cœur d'Alene Indians. They urged me to stop and take shelter from the rain, and my guide was determined to avail himself of the offer, but finding that I had pushed on without him, he rejoined me in the course of an hour. We made to-day twenty-four crossings of the stream, and encamped at dark in a small prairie, which the guide said was the last between this and the divide.

September 26.—Continued up the stream, and after making twenty-four crossings and passing over some very bad roads, on account of willow thickets and fallen timber, we came to where both the stream and the trail fork. The left-hand trail commences immediately the ascent of the mountain, while the other continues up the right-hand or northern fork, apparently through a valley similar to that up which we have been travelling; and this I wished, supposing it to be the route over which Lieutenant Mullan passed, and reported by him to be a better route than the one surveyed by Mr. J. M. Stanley. But my guide persisted in saying that it was a very bad road; that the mountains were high; that it was miry, and there was much fallen timber; and that the other was the only trail used for many years. Being therefore in doubt as to which was the trail explored by Mr. Stanley, and which by ——, we followed the trail to the left, and, after ascending for seventeen miles over mountains of very steep ascent, reached the summit, and it was then only that I could be certain this was the same route passed over by yourself and Mr. Stanley.

We encamped on the summit, at two small lakes, in a basin five hundred feet below us, and which were only accessible by a very steep road worn in the side-hill, showing that this is an old encamping ground.

September 27.—There was a heavy frost last night, as might be expected upon an elevation of some eight thousand feet above the sea. Early in the morning I ascended a point of rocks four hundred feet above our camp, and at sunrise, as the first rays touched upon the peaks of this seemingly boundless chain of mountains, the scene was beautiful and grand. This peak, which seemed to be the highest in the range, I have named Mt. Stevens. Upon the north side it is covered with luxuriant grass to the summit, while on the south it has a perpendicular descent of basaltic rock for one thousand feet, to the two small lakes, appearing, from this elevation, no larger than a mirror. From this point a good view of the whole country is obtained, and I sketched it in yesterday's route. It is evident that a better route than this can be obtained by following up the north branch of the St. Regis Borgia to its source and crossing a low divide to the Cœur d'Alene river. This is the route passed over by Lieutenant Mullan, and he will no doubt report upon it.

Continued to-day along the dividing ridge, alternately ascending and descending. The loftier and more dense growth of timber indicates that we are reaching a lower altitude. In ten miles travelling we reached the last descent, which is six thousand feet, almost perpendicular. The road has been rendered slippery by recent rains, and I esteem it fortunate to find myself and party in safety at its foot. In a quarter of a mile from the base of the mountain we struck the Cœur d'Alene river at its upper forks. The south branch comes from the high mountains on the southeast, while the north branch flows through an extensive valley running nearly due east and west; and through this valley passes the trail which it was my intention to pursue. I am confident that the best route is up this branch to its source, and passing over a divide which cannot be less than three thousand feet below the level of our last night's camp, to the St. Regis Borgia, down that stream to the Bitter Root river. Lieutenant Mullan, who passed over this route last spring, is of this opinion, and also expressed the belief that a good wagon road can be made through this pass at a moderate expense.

Continued down the river, crossing and recrossing frequently, and passing numerous small branches coming in on either side. The timber, chiefly fir and cedar, is of a size much superior to any we have heretofore seen. Many of the cedars were ten feet in diameter, and not less than two hundred and fifty feet in height. At 4 p. m. we reached the first grass since our encampment of last night. It is a small prairie upon the river, and is a good encamping ground for a considerable train. Pushing on five miles more we encamped at sundown, having made by estimate 22 miles for the day's march.

September 28.—The morning was clear and warm. Made an early start, and pushed on as rapidly as a road much obstructed by fallen timber and a dense undergrowth would permit. The valley is widening, and the timber more open and of smaller size. Having crossed the river sixteen times, the trail led over some low hills on the north side for five miles, and afforded a very good road. Recrossing the stream, which is here twenty yards wide and three feet deep, and passing through a fine prairie two miles in extent, we came to a wheat-field, which we gladly hailed as a sign of our near approach to civilization.

Following an old trail leading through open pine woods, in one mile more we crossed to the north side of the river, and emerging from the woods, stood upon the edge of a beautiful prairie. Near to us was a large field, well fenced and cultivated, and near its centre, upon a fine rise of ground, stood a handsome church, surrounded by a group of small houses, giving to the scene quite a village-like air. It was a pleasant sight to us, who for so long a time had not looked upon the slightest evidences of civilization. This is the Catholic Cœur d'Alene mission. Passing by the mission, we encamped one mile beyond, on a small lake near the river. Many of the Cœur d'Alene Indians were encamped near us, and several voluntarily assisted in unpacking the mules and arranging the camp, and seemed desirous of manifesting their friendship in various ways. Towards evening I walked up to the mission, and was most hospitably received by the Rev. Father Rovallie, the missionary in charge. He is an Italian by birth, has resided here ten years, and is a well-informed, intelligent gentleman.

With very limited means this mission has done much to civilize these Indians, and develop the agricultural capacities of the country. They now have some fifty acres under cultivation, and have succeeded in raising fair crops of wheat, oats, peas, potatoes, turnips, carrots, and hemp. The latter succeeds admirably, and might be made an important article of export from Washington and Oregon Territories.

A fine garden affords a supply of excellent vegetables. The climate, owing to the proximity of a lofty mountain range, is very cold during the winter, and even during the summer the nights prove too cold for the successful cultivation of Indian corn. Hay is requisite for stock through the winter, and is easily obtained from the prairies along the river.

Father Rovallie gave me an urgent invitation to remain with him several days, and also wished to accommodate my party at the mission; but it not being necessary to remain here long, and not wishing to break up the routine of camp life, I declined his kind offer. I, however, sat at his hospitable board during my short sojourn here, and for the first time in a year and a half enjoyed the luxuries of civilized life.

September 29.—To-day we remained in camp to repair pack-saddles, recruit the animals, and select some fresh ones from the few left here by Lieutenant Mullan.

September 30.—Made a late start, owing to trouble in catching the animals. Travelled down the river, which now bends to the south; traversing a succession of low prairies separated by thickets of scrub-pines, and climbing two hills to avoid dense undergrowth in the bottoms, in four miles we reached the crossing of Cœur d'Alene river. Here two Indians, with small bark canoes, awaited us. An hour was consumed in crossing, another in packing, and we then pushed on through a fine prairie stretching six miles down the river, and three or four in breadth, possessing an excellent soil. On the opposite side, lofty hills, wooded with pine, come down to the water's edge. We encamped at the lower end of the prairie, where a deep creek enters, having made to-day ten miles. The wagon road from the mission to this point is good, by bridging the Cœur d'Alene; which can easily be done, as the stream is narrow.

October 1.—The morning was clear and warm. The horses having strayed, we were unable to start before 11 a. m. Passing up the creek one mile, we crossed it where it debouches from a lake one mile in diameter, near which is another small one.

The trail leads through a fine prairie for four miles to another large lake, along the eastern shore of which we commenced the ascent of a mountain ridge.

To the summit is one mile, and ten days' labor would render it good for wagons. Thence the road is over a rolling country, timbered with scattering pines for seven miles, to the south branch of the Cœur d'Alene. Here, in a fertile valley, are four lakes, connected by narrow, deep streams. We crossed where the various streams or outlets unite and form the inlet to a large lake one mile below the crossing, which stretching to the northwest four miles, then bends to the southwest, and is hidden by mountains coming down to the south shore.

We encamped immediately after crossing, as there is no water within a day's march beyond. Upon the narrow tongue of land formed by the junction of the outlet of the lakes, and separated from our camp by only the width of the stream, were several lodges of Cœur d'Alene Indians, living in huts of bark and mats. They are principally old and decrepit people, and present a squalid, miserable appearance. Their chief food is fish and roots, of which they had a small supply, placed on scaffolds to preserve it from the dogs. Two old women crossed our baggage in canoes, for which I paid them fifty loads of ammunition, five feet of tobacco, and a few beads, fish-hooks, and rings.

During the night a legion of Indian dogs came across the river and began an attack upon our camp. It was simply a foraging expedition, and their appetites rejected nothing, even bridles, parfleches, lariats, &c. They kept me awake all night, and, in spite of my vigilance, devoured a fine lariat which I valued highly. The horses several times attempted to cross the river and take the "back track;" but as they must pass through the camp to do so, they awakened us, and we drove them back. It is thus animals are generally lost; they take the back track, for some unknown reason, and by morning are many miles from camp.

October 2.—Morning cloudy. The Indians were singing and praying nearly all night, and continued it this morning. Started early. The trail leads along the shore of the lake above us; the beach is of basaltic rock, in small fragments. Leaving the lake, we ascended a narrow valley, occasionally crossing the dry bed of a small stream, and in four miles reached the summit of the ridge, to which point the road is good for wagons, with little work; thence the country is generally rolling, sparsely timbered with pine, little undergrowth, and plenty of grass. The soil is an ashy loam. In ten miles passed a large prairie on the right, and in two more struck an extensive prairie stretching beyond view to the west; character rolling, and soil a black, sandy loam. This I suppose to be the Camash prairie of the Cœur d'Alenes. Struck across the prairie to a high ridge, and, following it to its base one mile, came to a thicket of willows surrounding a small spring. The water is indifferent, but there is an abundance of good grass. Here we encamped, as it is a long day's march to another encamping place. Large herds of horses were grazing on the prairies. They belonged to the Saptin or Nez Perces Indians, several of whom visited our camp, and were well-behaved.

October 3.—Morning clear and cool, with a heavy frost last night. Started early, passing along the base of the ridge, and over a good wagon road for one mile, when we began the ascent. It is a hill of six hundred feet elevation, of an easy ascent, and in one mile we reached the summit, when a splendid panorama opened around us—to the northeast, the blue peaks of the Bitter Root range; to the west, an ocean of rolling prairie; and south, on our course, the prairie stretched to far-distant mountains, marking, I presume, the course of the Great Snake river. Descending by a good road, we struck the dry bed of a creek, and followed down it. In four miles the trail forks, and we took the right hand, our course bearing upon a lofty pyramidal-shaped butte, towering alone above the prairie. Crossing some low hills for two miles, we fell into another valley or depression, and, some distance down, observed traces of a stream at some period of the year, and in ten miles came to a small clump of cotton-woods and willows near a pool of water, the first seen since our camp of last night, twenty-two miles distant. The course of the creek is now thinly bordered with small cotton-woods and willows. Towards evening we met three Indians and a white man carrying supplies of sugar, coffee, &c., to the mission. The white man, who is one of the "brothers" at the mission, made several complaints against one Geny, the government interpreter for this district—mainly that he opposed the mission, and excited the hostility of the Indians towards the Americans. The "brother" also informed me of the murder of twenty-three emigrants by the Snake Indians, and plots among all the Indians of Oregon and Washington Territories. In twenty-four miles from our last night's camp we came to an abundance of excellent spring-water, forming, in a short distance, a handsome brook. Three miles below we left this creek, where it bends sharp to the west, entering a narrow, rocky defile. Turning south, and crossing a rolling prairie, in five miles we struck a handsome creek, twenty feet wide and one foot deep, flowing over a pebbly bottom. Here we encamped in a fine bottom, affording luxuriant grass and a good growth of cotton-wood and pines. The valley of this stream is generally narrow, and bounded by precipices of basaltic rock. The soil is a rich loam. Made to-day 35 miles.

October 4.—Morning clear and warm. Made an early start, and, ascending from the valley by a long incline, struck into one of the numerous depressions or shallow valleys traversing this prairie in a southwest and northeast direction, or nearly east and west. Our course during the day was generally down these, crossing occasionally from one to the other over the low ridges dividing them, affording an excellent wagon road. In eighteen miles we reached a clump of cotton-wood trees, where was excellent water from small springs, forming a small stream running west. Continued down this valley seven miles, when my guide, finding himself in the wrong road, turned due south, and in six miles struck the right trail. The country is now somewhat broken, and basaltic rocks show in the summits of the hills. The country continued quite the same during the day, and in thirty-four miles from our camp of last night we reached several powerful springs, forming a large creek, which in two miles empties into the north branch of the Pelouse river, a fine stream fifty feet wide and two feet deep, which comes from the north, flowing through a fine valley bounded by high buttes and ridges of basaltic rock. The Indians have here a fish-weir, and I noticed an old field in which they had cultivated potatoes. It appears to me that we are making so much westing as to bring us below the mouth of the Pelouse, as laid down on the map. We encamped just above the mouth of the spring-brook, having made to-day 36 miles.

October 5.—I was awakened this morning by the rain falling on my face as I was sleeping in the open air—my usual custom when the nights are fair. Called the men, and had the tents pitched. The rain continued falling heavily until 11 a. m., when it ceased and the sun came out warm. Packed up, and had gone but a few rods when a violent storm of rain and hail burst upon us, thoroughly drenching us and stampeding the mules. Pushed on rapidly, leaving the river in three miles, and turning south. Country much broken by long flat-topped hills of black rock, and reminding me, in its general character, of the country between Dearborn and Sun rivers. In sixteen miles we struck the Pelouse river four miles above its mouth, and, passing down two miles, descended to the valley by a very long steep hill, which will require considerable labor to make it passable for wagons. Crossed the river, which is shallow, and no more than one hundred feet in width, and in a mile and a half more struck the great Snake river forty rods below the mouth of the Pelouse, where we encamped.

There is no wood here excepting drift-wood, and the Indians collect this for their winter use and for sale. We found, however, along the beach sufficient for our camp-fires. This is a miserable encamping ground, as there is no grass nearer than a mile, and then but little. There are no Indians here, and therefore no means of crossing.

October 6.—The morning was clear and cold. Sent the guide early up the river to look for some Indians to take us across, and about 10 a. m. descried an Indian in a canoe coming to our relief.

In an hour our packs were safely across, and the animals swam over without accident. The old Indian who ferried us presented me several papers or certificates of character; some setting forth that he was the best of Indians, and others that he was a most arrant scoundrel. It was 1 p. m. when we were packed up and ready for a start. My guide said it would be midnight before we reached a place to encamp, but, being determined to leave this barren place, I pushed on rapidly over a high-rolling prairie, bounded on the south by a range of mountains of a peculiar blue color verging upon a purple tint, and at 8 p. m. reached the Touchet river. A clear night and a full moon enabled us to find a good encamping ground a mile below where we first struck the river. The night was the coldest we have had this season, and we were not sorry to find sufficient drift-wood to make a comfortable fire.

October 7.—The morning was clear and frosty. The Touchet river is about twelve yards wide, and quite deep. The valley is narrow, and is overflowed at high water. About three miles below our camp is a better encamping ground, especially for a lage train. In three miles we left the river, which bends to the south, while our course is southwest by west over a level sandy plain, producing but little grass and an abundance of sage of small growth, indicating a poor soil. The trail then leads on a course south 60° west, true, direct to Fort Wallah-Wallah. At 3 p. m. obtained my first view of the Columbia river, for which I had departed from the Father of Waters more than a year ago. We hailed this glad sight as almost the termination of our long journey, and quickening our pace, reached the little Wallah-Wallah one mile above the fort; and at 4 p. m. entered its gates, and were hospitably received by Mr. D. Pambrun, the gentleman in charge. The fort is situated in the midst of desolate sand-hills, and there is no timber within sight. Our tent was pitched near the fort, and Mr. Pambrun supplied the men with wood, fresh meat, vegetables, &c., while I accepted the offer of a sojourn in his house during my stay.

October 8, *Sunday*.—Remained in camp awaiting the arrival of Lieutenant Mullan, according to our appointment to rendezvous at this point. The day passed pleasantly in reading and conversation.

October 9.—Morning cloudy, with a little rain. About 4 p. m. Lieutenant Mullan and party came in, having been twenty-one days from Cantonment Stevens, and experienced an unpleasant journey, owing to a difficult road, straying of the animals, &c.

October 10.—The day was chiefly employed in making preparations for a start to-morrow; Lieutenant Mullan proceeding to the Dalles, while I shall go up the Yakima, and, via the Snoqualme Pass, to Puget sound, if it is possible to procure a good guide.

October 11.—The animals were brought in, and after making the necessary exchanges, Lieutenant Mullan bade me farewell and started for the Dalles at noon. Soon after, we commenced crossing the packs, and at 5 o'clock had everything, including the animals, safely on the north bank of the Columbia, and the tents pitched. Taking leave of my kind entertainers, Mr. and Mrs. Pambrun, I crossed, and, seated at my camp fire, feel once more at home.

October 12.—A clear morning, with a cold north wind. As usual, on starting from a post, we made a late start. We travelled along the bank of the Columbia, up the stream, through a sandy barren sage plain of one to two miles in width, bounded by high ridges of basaltic rock parallel to the river. In eleven miles we passed the mouth of Snake river, coming in on the opposite side; and in thirteen miles more, struck the Yakima at its first crossing; and here we encamped, where the grass was excellent, but no wood, excepting some small willows.

October 13.—Made a late start. Crossed the river, and passing up six miles, crossed it again at an extensive fish weir. Here the river makes an extensive bend to the east, and, taking a cut-off, we struck the river again in seven miles, and continuing up seven miles farther, encamped.

October 14 *and* 15.—Continued up the river over the same route surveyed by a party under Captain McClellan, U. S. A.

October 16.—In three miles from camp we reached the mouth of the At-tah-nam, a small stream coming in from the west; and ascending it fourteen miles, reached a small Catholic mission, pleasantly situated in a grove of small white-oaks, the first I have seen since leaving Fort Union, on the Missouri.

The priest received me politely, but could give me little or no information concerning the Snoqualme Pass. No guide could be obtained nearer than two days' march; and he would be an Indian, to whom I could not express my wishes in regard to the several trails leading through the pass, and which Governor Stevens had directed me to examine. In addition, my barometer and sextant were unserviceable, and I therefore, although reluctantly, determined to proceed directly to Olympia by the emigrant road, dispensing with a guide.

We pushed on over high hills covered with bunch-grass, and encamped at sundown upon a small stream, which was called by some Indians who visited us, Te quy-wy-e-chass. Here is an abundance of luxuriant bunch-grass.

October 17.—We started early, and held northeast for ten miles, when we struck the Nahchess river, which is here a stream sixty yards wide and two feet deep, with a swift current. Crossed just at an extensive fish weir, where immense quantities of salmon are taken in the season, and it is said to be the best fishery on the Yakima. In three miles more we reached the Wenass river, and crossing it struck the broad trail of the emigrant road, and followed it to the point where it leaves the Wenass and crosses to the Nahchess.

October 18, 19, 20, *and* 21.—Pushed on as rapidly as our tired and sore-footed animals would permit. A minute description of the road and country is deemed unnecessary, as it has already been thoroughly explored and surveyed. But I must take this opportunity of expressing the opinion that the location of the road, and the work thereon, have been most judiciously and thoroughly performed under the direction and personal superintendence of Lieutenant Arnold, U. S. A. Wagons can now come over the road with but little difficulty, and an additional expenditure of $10,000 would make it an excellent mountain road.

On the morning of the 22d we reached the first settlements, and pushing on, encamped on Fennell's prairie, through which runs a small creek emptying into the Puyallup river. Mr. Fennell has a fine farm of rich soil; and, indeed, all the small prairies we have passed appear to be very fertile.

October 23.—We crossed the Puyallup and Nisqually rivers, and passing seven miles down the latter, encamped on a spring-brook. We are now among fine farms, cattle, pigs, chickens, &c.; and though singular and strange, they are by no means unpleasant sights to our eyes, so long unaccustomed to look upon them.

October 24.—We pushed on rapidly over a fine prairie country, and through occasional belts of pine timber of an enormous growth. The waters of the Pacific and the long looked for town of Olympia burst upon our delighted vision. We rode directly into town, and I was most cordially welcomed by my esteemed friend George W. Stevens, Esq., and Secretary C. H. Mason. Located in their hospitable house, truly I feel once more almost at home again.

Thus was terminated a reconnaissance from Fort Benton to Olympia in forty-seven days, including all delays.

Making a quick trip was not the object had in view, but rather to make a careful survey of the route, carrying out your instructions with reference to the agricultural capabilities of the country, and the feasibility of the country for wagon roads.

In this report the form of a brief journal has been adopted, as affording more minute, and consequently more satisfactory information than could be given in a general report.

A sketch of the reconnaissance is herewith submitted, and also the field-notes, which have been plotted precisely as taken in the field, and without off-sets to make them agree with previous surveys.

I am, very respectfully, yours, &c.,

JAMES DOTY.

Governor I. I. STEVENS,
In Charge of Northern Pacific Railroad Survey.

LETTER OF MR. L. BLODGET TO CAPTAIN A. A. HUMPHREYS, TRANSMITTING GENERAL NOTES ON THE CLIMATE ON ROUTE NEAR THE FORTY-SEVENTH AND FORTY-NINTH PARALLELS.

WASHINGTON, *August* 14, 1855.

DEAR SIR: The barometric and meteorological observations made in connexion with the survey of the route near the 47th and 49th parallels, which were recently received and placed in my hands, are scarcely sufficient for the general illustration of climate of the district traversed by the survey which was originally designed, and under which purpose those at the permanent posts were instituted. The observations made by the survey at the greater altitudes, both at temporary posts and on the several lines, are indispensable for this purpose, and further measurements are necessary of the amount of precipitation at all altitudes. There are two valuable series, however, at Fort Benton and at Cantonment Stevens, St. Mary's valley, of nearly a year each. These were taken with great care, and, as they would best supply the lost journals of the survey, as well as give positive results in regard to the climate of a new district, they appear worthy of publication in detail. They have, therefore, been carefully prepared for that purpose, and are followed by summaries at Fort Pierre, on the Missouri, Columbia barracks, and Olympia, and by the journal of the survey of Lieut. Mowry, east of the Cascade mountains.

For other explanations, and for some deductions and comparisons in regard to the general climate of the district, I beg to refer you to the general notes and remarks prefacing the tables.

Very respectfully, your obedient servant,

L. BLODGET.

Capt. A. A. HUMPHREYS,
Top. Engs., in Charge of Office of P. R. Surveys.

GENERAL NOTES ON THE CLIMATE ON THE ROUTE NEAR THE 47TH AND 49TH PARALLELS, BY MR. LORIN BLODGET.

The number of meteorological observations made within a few years at the military posts on the coast of the Pacific, is sufficient to have furnished a very good knowledge of that climate already, and its more striking features are comparatively well understood. For the interior and the mountainous districts, however, there are but few records, and none have been given to the public from points north of the latitude of Fort Hall and west of Fort Union, on the Missouri. It was intended to establish a sufficient number of posts on the western border of the plains, and in the mountains and interior valley of Washington Territory, to represent every distinguishable district, and to permit a comprehensive comparison of them. In the present result there are two or three of these more important points embraced, but it is yet difficult to connect them in an intelligible manner, or to show where the distinctions are. Comparisons of temperature may be made with some accuracy from the records at hand, and these, with other obvious features, may be given in general terms.

Fort Benton and St. Mary's valley represent the more elevated plains and valleys on each side of the Rocky mountains, and each may be taken as decisive of the climate of a large district. The observations in detail at these points would very well represent the itinerary of a survey line for corresponding months for a considerable distance on either side, and they are given in full to answer the purpose of this required knowledge of details. Between these two points there is little of definite observation, and it is not certain how far their comparisons may be carried. It scarcely appears whether the abrupt contrasts of the mountains of the Pacific coast exist here or not, either in the temperature or in the amount of precipitation in rain and snow. There is not sufficient observation also of the Cascade range of mountains, or of the dry plains immediately at the east of them, especially in regard to amount of rain and snow. The journal of Lieut.

Mowry gives some valuable temperature observations on this eastern base of the Cascades, and his condensed notes of results are very well sustained by all the observations. A continuous record at Fort Okinakane or Fort Colville would, apparently, have many features in common with one at St. Mary's valley for the colder months; yet, for the summer, there must be some prominent points of difference. Each of these districts is decidedly separable from the immediate coast of the Pacific west of the mountains, and has little in common with it at any season.

The comparisons which would illustrate the relation of the climate on the western border of the plains of the Missouri to those of the east, or of known points on the Mississippi valley, are first necessary, and they may now be made directly with these points for the same months. The record at Fort Pierre unfortunately does not commence until nearly the last of the months observed at Fort Benton, and it cannot, therefore, be introduced at the point where it is most desirable. The elevation of Fort Benton above the sea is 2,662.9 feet by the mean of all the barometric observations taken there.[*] The most conspicuous feature of the temperature of the post is its near agreement with that of posts on the eastern border of the plains—even in lower latitudes, as Forts Snelling and Leavenworth—from the commencement of the record to the close of October. For the portion of September observed, and for the whole of October, it was warmer than Fort Snelling, and but little cooler than Fort Leavenworth. The extremes of 80° for the highest, and 10° for the lowest degree, are nearly the same as at Fort Snelling, where the lowest degree in October is 8°—the lowest at Fort Leavenworth being 22°. The lowest at Fort Laramie for October is 20°. At the close of the month there were severe storms, with but little rain or snow, however.

For November the range of temperature was low, and on six days at or below zero. The monthly mean was ten degrees less than at Fort Snelling, and 24.5° less than Fort Leavenworth. It is also 14.5° less than that of Cantonment Stevens, on the west of the mountains. The fall of the temperature as winter approaches appears to be much more abrupt east of the mountains in his latitude than at the west, or in the vicinity of the great lakes. There were few storms and very little snow.

The record for December is quite anomalous, and, if not affected by position of the thermometer, gives an extraordinarily high temperature. At all other posts of the Northwest—Forts Snelling, Kearney, Laramie, &c., east of the mountains, and at Cantonment Stevens and Olympia on the west—the temperatures of December are several degrees below those of November, while, as recorded here, December is 13.5° warmer than November. The record is very nearly the same as that at Fort Laramie for the same month, though colder than this post in November by 22° in the mean temperature. A peculiarity so remarkable should be verified in the most complete manner, as it would go far to prove the distinctive features of the climate of the northern portion of the plains east of the mountains, to be quite separable from those farther south and east. The changes occurring at every point from the longitude of Fort Kearney eastward are so far associated as to produce marked correspondence among all the stations of a very large area. The ordinary relation of the temperatures of the winter months is sometimes reversed, but in every case the whole country participates in some measure in the change.

At Great Salt lake, as observed by the Central Survey, the temperature of December is much above that of January following, and also apparently much above the average, though there are but few observations in the same month in previous years with which to compare it. In 1854 the mean of December at Great Salt lake was 31.3° against 41.5° in 1853. These facts favor the view that the temperature changes of this meridian may not necessarily be associated with those of either side of the mountains at great distances.

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[*] The comparison of the barometer used with a standard is not given in connexion with the observations. It was a syphon, by Green, No. 769, and it is only known that it is reported as in good order by Mr. Doty.

The determination of altitude is made by assuming a mean barometric reading of 30.000 inches at sea-level, the reading reduced to freezing point, and a mean air temperature of 50°.

In January, 1854, the cold was intense at Fort Benton and at St. Mary's valley. It was still more severe, however, at all points near this latitude eastward as far as Fort Mackinac, and nearly the same at Fort Kearney, in latitude 41°. On thirteen days the thermometer was below zero at Fort Benton; at Fort Snelling the corresponding number of days was twenty-three, and at Fort Kearney fourteen; the lowest single readings being respectively 24, 36, and 16 degrees below zero. In February, the remaining month of winter, the mean temperature was 11° above that of Fort Snelling, and 4° below that of Fort Kearney. The low extremes at these posts were — 6°, —20°, and + 2°, respectively. The post was 4° colder than St. Mary's for the same month.

In each of the months of spring, nearly the same relation of temperatures was preserved to stations eastward. March and April were each 5° warmer at Fort Benton than at Fort Snelling, and April was warmer than at Fort Kearney. In May there was very little difference at the three posts. March only was colder than at St. Mary's, and the mean of the three months was greater at Fort Benton than west of the mountains.

The summer of 1854 had nearly the same mean temperature for each of the three posts previously compared; that of Fort Benton being 72.8°, Fort Snelling 72.1°, and Fort Kearney 73.4°. St. Mary's valley has a mean of 69.6°. The extremes of temperature range as high here, also, as at stations eastward on the plains, the summer maximum being 100°.

The corresponding record at Fort Pierre first appears in July, with a mean temperature of 76.9° against a mean of 73.6° at Fort Benton, and the differences for August and September are not large. The high summer temperatures of the plains at the sources of the Missouri are a very decided and well established feature.

The range of temperature in successive months and for less periods has unusual characteristics at Fort Benton, as exhibited in the high temperatures of December, 1853, and April, 1854. In several instances warm days occurred in the winter months in connexion with high southwest winds. It is remarked by Mr. Doty that these winds are also attended with a fall of barometer, though this does not appear in the record as a marked result. In May, 1854, there were two days on which snow fell, and the temperature was below the freezing point.

For the year the mean temperature compares very nearly with that of Fort Kearney, which is quite similar in the corresponding seasons, and it is three or four degrees above that of Fort Snelling, the excess occurring in winter and spring.

The hygrometric observations during the autumn of 1853 were taken in-doors, and have no value as measures of the dryness of the atmosphere. They were resumed in April, 1854, and appear to be correctly taken to the close of August. The differences they give for the readings of the dry and wet thermometers are quite large; and though a mean of these gives but a rude approximation towards the true results of proportion of moisture in the air, some intelligible idea may still be obtained from them. Arranging these mean differences, for the several hours from May to August, we have the following results:

Mean differences of readings of the wet and dry thermometers at

	7 a. m.	2 p. m.	9 p. m.	Mean for month.
	°	°	°	°
May 1854	5.7	13.3	7.1	8.7
June ....do	7.4	16.1	8.0	10.5
July ....do	12.2	20.7	12.2	15.0
August ......do	15.6	23.5	11.0	15.7

If correctly observed, these show a climate similar to that of New Mexico, and the arid portions of the plains, and of California. The maximum of single differences in the Atlantic States rarely exceeds 16°, and on the mean for a month does not reach 8°. In this case, the observations for August give as the mean per-centage a proportion of saturation but 31 for the hour of 7 a. m., and but 20 for that of 2 p. m. That of 9 p. m. is 48, and the mean 33, against a mean of near 75, or an average in the Mississippi valley and the Atlantic States. The calculation in detail would give very low proportions of atmospheric moisture in many cases; and though this detail is the only accurate mode of obtaining these proportions, the measures here given are a near approximation.

The quantity of rain is quite imperfectly observed in the record at Fort Benton for several months. The amount is apparently small for the year, the winter and spring having evidently the greatest quantity, and each near five inches. The rains not measured in summer are not noted as profuse in any case; and the distribution seems to partake somewhat of that peculiar to the Pacific climates, which have least in summer. On the plains, the greatest quantities are in spring, and other seasons are often quite without rain. The strong southwest winds, with the high temperature and barometric oscillations then noted at Fort Benton in the winter months, prove a connexion to exist with the Pacific climates which does not appear at any other point of the plains. In these cases the precipitation is doubtless profuse, in rain or snow, on the mountains of this vicinity.

The barometric oscillations at Fort Benton and St. Mary's are also quite conformable and identical with each other when projected in curves. They exhibit marked movements in some instances quite sudden, and of great range in the winter months, and connect the attendant storms beyond a doubt, as belonging to similar climates at this season.

The record at St. Mary's valley requires less analysis and comparison, to illustrate its relation to known climates. The position is elevated nearly a thousand feet above Fort Benton, (3412.5 feet above the sea,) yet its winter climate is equally mild, and the extremes at that season not more severe. In summer, however, the low temperatures of the Pacific coast are felt, and extremes occur much greater than those at Fort Benton. April has a mean temperature 6.5 degrees lower at Cantonment Stevens, and May 2.5 degrees. In May there is snow on the 7th, as at Fort Benton; and on the 28th snow again, two inches in depth, and rains; none of which appear at Fort Benton.

In July snow fell on the 6th in small quantity. In the frequent rains of the summer months on the mountains of the vicinity, if not at the post, the sudden changes of temperature and of wind peculiar to mountain regions appear characteristic, and to distinguish the climate here at that season from that of the plains east of the mountains, as well as those towards the Pacific.

The quantity of rain is not measured at this post for any part of the period of observation. Rains are noted frequently in the remarks, and the number of days of rain and snow may be given here, and in comparison with Fort Benton:

	Cantonment Stevens, St. Mary's valley.		Fort Benton.	
	Days rain.	Days snow.	Days rain.	Days snow.
October....1853, (21 days)	4	4	1	3
November ...do	7	10	0	4
December ...do	3	8	0	1
January 1854	4	10	0	7
February ....do	0	8	1	3
March ....do	6	7	1	6
April..........do	7	2	4	0
May.........do	8	2	4	2
June ....do	10	0	6	0
July ....do	3	1	2	0
August ....do	7	0	4	0
September...do.	10	0	....	....

The climate of the district between the Rocky mountains and the Cascade range, comprising much the largest portion of Oregon and Washington Territories, has many of the characteristics peculiar to mountain regions. These seem to belong to the low plain and valley of the Columbia much more than to the Missouri valley and plains at Fort Benton, and their distinguishing points of great daily range of temperature and abrupt changes of wind and weather are as conspicuous in the journal of the expedition along the eastern base of the Cascade mountains as in the record at St. Mary's valley. This line of reconnaissance was but little elevated above the sea at most points.

The Cascade range has a most decisive effect on the climate of the district east of it, which is mainly due to its great elevation and high latitude. The equable temperatures of the immediate coast would otherwise be felt as far inland as in the corresponding European districts, where they directly control the climate of nearly half the continent. The Pacific coast has this local feature abruptly changed by the intervention of these mountains, and the modification of climate which remains is only felt in the generally high temperature of the western portion of the continent. All portions of the western border of the continent, even from the Mississippi river, participate in these higher temperatures at all altitudes, and the great elevation of the mountain ranges and plateaux there has alone obscured this fact. It does not, however, render the contrasts peculiar to arid valleys and the vicinity of high mountains less conspicuous, though the mean of their temperatures is much higher.

Thus, the mean temperatures at St. Mary's and in the dry plain of the Columbia are greater than those of the coast, if the lowest scale of allowance for altitude be applied; yet the range of successive months is very great, and the range of simple extremes even greater than these last in proportion.

The high summer temperatures of this region are scarcely less noticeable than on the plains of the Missouri, though the daily range is so much greater here as to distinguish the climates as quite unlike. All the plain of the Columbia, though but little elevated above the sea, appears to participate in the abrupt daily changes peculiar to mountain regions, and this is doubtless mainly due to the great altitudes of the Cascade and Coast mountains, which shut it from the coast of the Pacific.

The several detailed reports in connexion with special reconnaissances show that the climate of the mountain districts is generally milder than would elsewhere belong to corresponding latitudes and altitudes. Mountainous districts on the eastern portion of the continent in these latitudes would present records of temperatures much lower and more severe. It is, however, not less extreme in its changes, and generally not less profuse in precipitation for the prominent ranges. Those near the coast arrest a very large precipitation at all seasons, and are sufficiently elevated to convert most of it into snow, except in the three months of summer. As the intervening plains, before reaching the Rocky mountains, are so low, there is comparatively little of rain or snow on them, and the higher portions of the Rocky mountains must again receive a large precipitation. East of the mountains the quantity of rain or snow in the extreme seasons of summer and winter is but a very small amount, and the profusion is mainly in spring and early summer.

These records show greater correspondence of the districts east of the Cascade range of mountains with those of the mountain plateaux southward, in regard to local aridity and to the attendant daily extremes of temperature, than could have been anticipated of so high a latitude. These peculiarities do not seem dependent on altitude alone, also, as they belong as decidedly to the low plain of the Columbia as to the Great Basin at 4,500 feet elevation above the sea.

At the coast of the Pacific the daily and monthly ranges of temperatures are very small, and the climate at Puget sound has the equable features without the unpleasant peculiarities of that of the California coast. The humidity and amount of precipitation is very great in comparison with the interior, and greater when measured by the per-centage of humidity, and the number of cloudy and rainy days, than in almost any part of the United States. The quantity of water falling is not excessive, however, and there is very little snow. The winter precipitation is greatest, and embraces almost all, if the connected months, which may be so called, are included, and the fall at sea-level is almost always rain. This winter rainy season is identical in character along the whole Pacific coast of the United States, being only shorter, by commencing later and closing earlier in regular decrease southward from Puget sound. The attendant winds and phenomena are also identical—the constant southeast wind and the low range of the barometer.

The detailed reports of the several reconnaissance parties, and that accompanying the principal report of Governor Stevens, embrace all the points of interest presented by the observations which have not been alluded to here. It is still scarcely possible to review the extensive field covered by the survey, or its collateral interests, in a satisfactory manner.

METEOROLOGICAL OBSERVATIONS AT FORT BENTON AND CANTONMENT STEVENS, ST. MARY'S VALLEY.

Observations made at Fort Benton, Upper Missouri river, for the month of September, 1853, by James Doty, Esq.

Latitude 47° 50′; longitude 110° 35′ 45″; height of station above the sea, 2662.9 feet.

NOTE.—The barometric observations were made in an adobe building, in which there was no fire until October 12, when a large standard thermometer was put up on the north side of the house, open to the air, and uninfluenced by reflected heat. The barometer was placed in the open air on the 4th of November.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Sep. 24	27.078	26.984	27.033	27.032	60	75	66	67	5	0	3	NE. 1 SW. 4	2	0	0	SW. 1	0	10 p. m.	....	....	Violent NW. wind, with slight rain at at 5 p. m.
25	.268	27.279	.333	.293	58.2	57	61.5	58.9	10	0	10	0	10	0	E. 2	E. 2	NE. 2	....	....	....	Continued to sprinkle.
26	.403	.429	.431	.422	60	57	64	60.3	10	0	8	N. 1	10	0	NW. 1	N. 1	NE. 1	....	4 a. m.	1.612	
27	.482	.358	.232	.357	54	62	62	59.3	5	E. 2 N. 3	10	0	0	0	NE. 3	E. 1	N. 1	....	....	....	
28	.230	.198	.297	.242	58	61	61	60	10	0	10	0	1	NE. 1	0	NE. 2	NE. 1	....	....	....	Cool, heavy fog; clear at 8 a. m.; slight rain at 5 p. m.
29	.454	.445	.403	.434	56	63	62	60.3	0	0	0	0	3	N. 1	W. 1	W. 1	N. 1	....	....	....	
30	.439	.425	.435	.433	51	65	64	60	0	0	1	0	0	0	0	N. 1	0	....	....	....	Warm and hazy.
Means..	27.336	27.302	27.309	27.316	56.7	63.0	63.0	60.9	....	....	..	....	....	....	....	....	....	....	....	1.612	

In the notation of clouds, 0 signifies an entirely clear sky, and 10 one entirely cloudy. The force of wind and the velocity of motion of the clouds are in tenths, from the least to the greatest velocity.

Observations made at Fort Benton, Upper Missouri river, for the month of October, 1853, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Oct. 1	27.473	27.459	27.438	27.454	57	73	68	66.0	0	0	0	0	1	N. 1	0	0	N. 1				Clear.
2	.461	.433	445	.446	61	73	67	67.0	1	S. 2	0	0	4	0	S. 2	S. 1	0				Clear.
3	.462	.397	.371	.410	58	73	67	66.0	4	0	0	0	0	0	0	SW. 2	0				Clear.
4	.408	.387	.373	.389	62	75	69	68.7	4	N. 2	0	0	0	0	N. 2	0	0				Clear.
5	.353	.143	.117	.204	56	77	71	68.0	0	0	0	0	0	0	0	SW. 1	0				Clear.
6	.167	.186	.215	.189	67	72	68	69.0	0	0	0	0	2	N. 1	SW. 3	SW. 3	N. 1				Clear.
7	.266	.290	.322	.293	52	61	61	58.0	0	0	2	SW. 2	0	0	N. 1	SW. 2	SW. 1				Clear.
8	.321	.295	.204	.273	30	65	33	42.7	0	0	3	SW. 1	0	0	SW. 1	SW. 1	0				Heavy frost; ice ¼ inch thick.
9	.179	.069	.036	.095	50	70	35	51.7	0	0	0	0	0	0	0	0	0				
10	26.959	26.918	.034	26.970	29	60	34	41.0	0	0	8	W. 4	3	W. 1	0	SW. 5	W. 3				Heavy frost; clear.
11	27.182	27.154	26.984	27.107	59	70	65	64.7	10	0	0	0	0	0	N. 1	0	0				Clear.
12	26.979	26.950	27.193	.041	58	70	66	64.7	0	0	2	S. 2	0	0	E. 1	SW. 3	SW. 1				Thermometer, out door, 81° at 3 p. m.
13	27.336	27.318	.341	.332	53	69	52	58.0	0	0	1	0	1	0	N. 1	SW. 2	0				
14	.361	.302	.274	.312	65	77	63	68.3	1	0	0	0	0	0	SW. 1	SW. 1	0				
15	.236	.150	.242	.209	65	79	64	69.3	0	0	2	S. 10	10	0	0	SW. 3	SE. 1				
16	.392	.429	.382	.401	64	71	63	66.0	0	0	5	NE. 2	2	NE. 1	N. 1	NE. 2	NE. 1				
17	.336	.158	.122	.205	63	80	63	68.7	0	0	0	0	0	0	0	SW. 2	0				
18	.147	.153	.207	.169	60	74	63	65.7	5	W. 1	10	0	8	0	W. 1	SW. 2	NE. 1				
19	.293	.322	.337	.317	51	57	59	55.7	10	E. 2	8	SW. 2	1	0	E. 2	SW. 2	0				Few drops of rain at 7 a. m.
20	.381	.399	.567	.449	37	53	54	48.0	10	0	10	0	10	0	E. 1	NW. 3	N. 2				
21	.612	.638	.638	.629	36	42	30	36.0	3	W. 2	10	W. 2	10	0	W. 2	NW. 2	N. 2				Flakes of snow at 5 p. m.
22	.686	.564	.369	.539	15	39	30	28.0	0	0	0	0	9	0	NW. 1	W. 3	N. 1				
23	.443	.411	.386	.413	10	40	25	25.0	0	0	2	N. 1	0	0	0	N. 1	N. 1				
24	.156	.046	.084	.095	20	29	22	23.7	10	0	10	0	10	0	NE. 3	NE. 2	0	8 a. m.	10 p. m.	0.175	Two and a half inches of snow.
25	.187	.160	.172	.172	19	31	11	20.3	10	0	1	N. 1	0	0	0	N. 1	0				
26	.024	26.898	26.901	26.941	31	47	42	40.0	10	0	7	S. 4	10	SE. 4	SE. 3	S. 4	SE. 4				
27	.020	27.192	27.307	27.173	36	51	43	43.3	10	SW. 3	9	SW. 1	10	SW. 4	SW. 3	SW. 2	SW. 4				
28	.414	.442	.379	.412	45	57	47	49.7	0	0	3	SE. 4	1	NE. 5	N. 1	SE. 4	SE. 4				
29	.322	.297	.284	.301	57	66	55	59.3	10	SW. 4	10	SW. 6	10	SW. 0	SW. 0	SW. 0	SW. 6				
30	26.993	26.792	26.849	26.878	62	67	53	60.7	10	NW. 6	10	NW. 5	0	0	SW. 0	SW. 7	SW. 5	7 p. m.	11 p. m.	0.012	Snowing at night.
31	27.182	27.152	27.149	27.161	33	40	32	35.0	0	0	3	NE. 1	10	0	NE. 1	NE. 1	0				Three-fourths of an inch of snow.
Means.	27.264	27.239	27.251	27.258	47.13	61.58	50.80	53.17	3.48		3.77		3.01							0.187	

Observations made at Fort Benton, Upper Missouri river, for the month of November, 1853, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Nov. 1	27.384	27.469	27.496	27.449	30	21	9	20.0	10	N. 1	10	0	10	0	NE. 2	NE. 1	0	....	....	....	
2	.545	.409	.420	.458	5	32	18	18.3	10	0	3	0	10	0	N. 1	N. 1	N. 2	....	....	....	
3	.518	.559	.606	.561	9	22	18	16.3	2	0	10	0	10	0	0	N. 1	N. 2	....	....	....	
4	.798	.863	.854	.838	9	8	—2	5.0	10	0	10	N. 1	1	N. 1	NE. 2	N. 2	N. 1	....	....	....	Bar. No. 767 placed out doors.
5	.717	.579	.624	.640	0	12	6	6	10	N. 1	10	N. 1	10	N. 1	NE. 1	NE. 2	N. 1	....	....	....	Great quantity of ice running; few flakes of snow.
6	.227	.047	.043	.106	9	23	14	15.3	10	0	4	N. 1	1	0	0	0	0	....	....	....	
7	.027	.942	.224	.064	8	44	16	22.7	1	0	8	W. 2	10	SW. 2	N. 1	S. 3	SW. 3	....	....	....	
8	.604	.574	.457	.545	8	25	24	19	0	0	8	NE. 2	10	W. 3	0	N. 1	N. 1	....	....	....	
9	.209	021	.022	.084	24	56	46	42	10	SW. 4	7	SW. 3	10	SW. 3	SW. 4	SW. 5	SW. 4	....	....	....	
10	26.858	26.703	26.758	26.773	44	51	41	45.3	10	SW. 3	10	SW. 2	10	0	SW. 3	SW. 4	0	....	....	....	Mild, but very cloudy and dark all day.
11	27.013	.926	27.210	27.049	18	45	22	28.3	10	W. 1	10	WSW. 4	4	N. 1	NE. 2	SW. 5	N. 1	....	....	....	
12	.186	.860	26.799	26.948	11	34	44	29.7	1	N. 1	10	0	10	0	N. 1	SW. 1	SE. 4	....	....	....	
13	.005	.901	.887	.931	23	45	38	35.3	0	0	10	0	10	W. 3	N. 1	NE. 1	SW. 4	....	....	....	Clear and warm morning; no ice in the river.
14	.310	27.214	27.105	27.210	9	30	29	22.7	0	0	0	0	6	N. 1	0	N. 1	N. 1	....	....	....	
15	.136	.079	.160	.125	27	46	20	31	4	N. 1	6	N. 1	10	N. 1	0	N. 1	N. 1	....	....	....	
16	.051	.043	.127	.074	9	46	10	21.6	0	0	0	0	0	0	NW. 1	0	N. 2	....	....	....	Clear and warm.
17	....	....	26.591	.136	0	18	13	10.3	1	0	1	0	1	0	N. 1	E. 1	N. 1	....	....	....	
18	26.061	.082	27.152	26.965	5	25	22	17.3	10	0	0	0	8	N. 1	E. 1	N. 1	N. 1	....	....	....	Very cloudy and dark; few flakes of snow falling.
19	27.198	.198	.179	27.192	7	20	20	15.7	4	N. 1	1	0	0	0	N. 1	N. 1	0	....	....	....	
20	.033	.049	.257	.113	43	58	24	41.6	3	SW. 1	6	SW. 4	1	SW. 3	SW. 2	SW. 5	SW. 2	....	....	....	
21	.360	.263	.215	.266	6	22	18	15.3	10	0	10	N. 1	8	N. 1	N. 2	N. 2	N. 1	....	....	....	
22	.234	.251	.387	.291	11	15	12	12.7	5	N. 1	10	NE. 1	10	NE. 1	N. 1	NE. 1	N. 1	....	....	....	Few flakes of snow falling.
23	.657	.710	.559	.642	6	8	8	7.3	10	NE. 2	10	NE. 1	10	NE. 1	NE. 1	NE. 1	NE. 2	4 p. m...	9 p. m...	0.100	1½ inches snow.
24	.385	.509	.506	.466	0	12	5	5.7	4	0	10	0	10	N. 1	N. 1	NE. 2	N. 1	7 p. m...	9 p. m...	0.100	1 inch snow.
25	.309	.276	.273	.286	—2	11	5	4.7	10	N. 1	10	N. 1	10	0	N. 1	N. 2	N. 1	....	....	....	
26	.079	.009	.081	.056	8	22	14	14.6	10	0	10	0	3	NE. 2	N. 1	N. 1	0	....	....	....	River frozen entirely across; first time this winter.
27	.206	.138	.244	.196	6	10	2	3.7	10	NE. 2	10	NE. 2	10	0	NE. 2	NE. 3	N. 2	7 a. m...	4 p. m...	0.100	Snowing very slowly all day.
28	.285	.288	.281	.285	0	7	1	2.6	5	0	2	0	10	0	0	N. 1	N. 1	....	....	....	Some men crossed the river on the ice.
29	.028	.054	.167	.083	10	16	14	13.3	10	0	8	N. 1	8	SWW. 2	N. 1	N. 1	0	....	....	....	Thawing rapidly.
30	.009	.343	.382	.244	42	38	33	37.6	10	SW. 2	8	SW. 3	10	SW. 3	SW. 3	SW. 1	SW. 1	....	....	....	
Means.	27.035	27.012	27.035	27.027	12.90	27.40	18.13	19.46	6.33	....	7.0	....	7.3	....	....	....	....	....	....	0.300	

Observations made at Fort Benton, Upper Missouri river, for the month of December, 1853, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour begun.	Hour ended.	Amo'nt, inches.	
Dec. 1	27.314	27.386	27.373	27.358	27	30	20	25.6	8	SW. 2	4	S. 1 SW. 2	10	0	0	SW. 2	N. 2	....	....	....	
2	.212	.216	.239	.222	23	48	44	38.3	5	W. 2	10	SW. 2	10	0	0	SW. 2	0	....	....	....	Ice gone in channel of river.
3	.318	.136	.241	.232	31	56	42	43.0	2	0	2	SW. 2	0	0	0	SW. 5	0	....	....	....	Warm, pleasant weather, with the barometer reading low during all the time the wind is SW.
4	.310	.080	.027	.139	30	36	44	36.7	0	0	1	0	0	0	0	SW. 1	W. 1	....	....	....	
5	.315	.361	.404	.360	37	54	34	41.7	2	0	0	0	0	0	SW. 2	SW. 2	0	....	....	....	
6	.474	.544	.539	.519	34	56	32	40.6	0	0	0	0	0	0	0	SW. 3	0	....	....	....	
7	.413	.415	.450	.426	28	58	40	42.0	2	SW. 2	2	SW. 1	1	SW. 1	SW. 3	SW. 2	SW. 1	....	....	....	
8	.284	.060	26.980	.108	41	60	50	50.3	2	SW. 1	0	0	0	0	0	SW. 3	0	....	....	....	
9	26.847	26.810	.888	26.848	42	55	40	45.7	1	0	4	SW. 3	3	SW. 4	SW. 1	SW. 4	SW. 3	....	....	....	
10	27.146	27.090	931	27.056	26	41	38	35.0	0	0	0	0	2	N. 1	0	SW. 4	N. 1	....	....	....	
11	.308	.451	27.347	.369	27	32	20	26.3	10	N. 1	3	N. 2	0	0	N. 2	N. 3	0	....	....	....	
12	.157	26.988	26.997	.047	25	56	37	39.3	10	SW. 1	10	SW. 3	5	NW. 2	0	SW. 4	N. 1	....	....	....	
13	.116	27.259	27.447	.274	26	50	28	34.7	0	0	3	0	7	N. 1	0	0	N. 1	....	....	....	
14	.435	.374	.418	.409	16	34	19	23.0	2	N. 1	1	N. 1	0	0	N. 1	N. 1	N. 1	....	....	....	
15	.636	.458	.097	.397	19	34	19	24.0	5	N. 1	2	N. 1	4	0	N. 1	N. 1	NE. 1	....	....	....	Very cloudy and dark, and every appearance of snow.
16	.294	.295	.191	.260	35	41	36	37.3	10	0	0	0	10	0	0	0	NE. 1	....	....	....	
17	.065	.195	.341	.200	43	39	32	38.0	10	SW. 4	3	SW. 1	4	SW. 1	SW. 5	SW. 1	SW. 2	....	....	....	Few flakes of snow during the day, about ¼ inch.
18	.493	.505	.488	.495	24	32	15	23.7	2	NW. 1	2	NW. 2	4	N. 1	NW. 1	NW. 1	NW. 1	....	....	....	
19	.422	.228	.097	.249	10	25	18	17.7	3	N. 1	2	NW. 1	2	NW. 1	NW. 1	NW. 1	NW. 1	....	....	....	
20	26.989	.036	.211	.079	14	20	16	16.7	5	W. 1	8	SW. 1	10	SW. 1	NW. 1	SW. 1	SW. 1	....	....	....	Snowing very slowly.
21	27.382	.204	.288	.291	16	21	6	14.3	10	SW. 1	8	SW. 1	2	W. 1	SW. 1	SW. 1	SW. 1	....	....	....	
22	.185	.190	.101	.159	0	30	22	17.3	1	W. 1	2	NW. 1	2	SW. 3	NW. 1	NW. 1	SW. 1	....	....	....	
23	.000	26.982	.002	26.995	35	40	26	33.7	8	SW. 3	8	W. 4	0	0	SW. 2	SW. 5	W. 2	....	....	....	Appearances indicate rain, but it never storms here with wind from SW.
24	037	.949	26.994	.993	10	38	27	25.0	8	N. 1	8	W. 5	10	SW. 4	N. 1	SW. 4	SW.	....	....	....	
25	.071	27.031	27.006	27.036	24	34	35	31.0	6	SW. 4	10	SW. 4	10	SW. 4	SW. 4	SW. 4	SW. 4	....	....	....	
26	26.982	26.969	26.937	26.963	35	42	39	38.7	3	SW. 4	10	SW. 2	10	SW. 2	SW. 3	SW. 2	SW. 3	....	....	....	
27	27.023	27.066	27.120	27.069	33	46	35	38.0	10	SW. 2	8	SW. 2	8	SW. 1	SW. 3	SW. 2	SW. 2	....	....	....	
28	26.983	26.767	26.810	26.853	48	58	40	48.7	5	SW. 3	2	SW. 3	0	0	SW. 4	SW. 4	SW. 4	....	....	....	
29	27.053	27.194	27.327	27.191	28	32	29	29.7	10	SW. 2	10	SW. 3	10	SW. 4	SW. 3	SW. 2	SW. 4	....	....	....	
30	.376	.250	.237	.288	22	40	38	33.3	10	SW. 3	10	SW. 3	10	SW. 3	SW. 3	SW. 3	SW. 4	....	....	....	No snow or rain during this month.
31	.439	.398	.382	.406	33	43	25	33.7	10	SW. 3	10	SW. 1	0	0	SW. 2	SW. 1	0	....	....	....	
Means.	27.218	27.193	27.197	27.203	27.16	41.32	30.52	33.00	5.16	....	4.61	....	4.33	....	....	....	....	....	....	....	

Observations made at Fort Benton, Upper Missouri river, for the month of January, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Jan. 1	27.386	27.181	27.078	27.215	41	50	50	47	2	SW. 4	10	SW. 4	10	SW. 4	SW. 4	SW. 3	SW. 5	....	....	....	Clear; cloudy; overcast; warm all day.
2	.061	26.926	26.714	26.900	47	54	54	51.7	10	SW. 4	10	SW. 5	10	SW. 5	SW. 4	SW. 5	SW. 5	....	....	....	Cloudy and hazy; hazy, warm; overcast, wind violent.
3	26.828	27.136	27.243	27.069	17	11	6	11.3	10	E. 4	10	E. 1	10	E. 1	NE. 3	NE. 2	NE. 2	Snow, 4 a. m.	1 p. m.	0.560	Snowing; cloudy and growing cold; (2.5 inches snow.)
4	27.566	.617	.727	.637	−11	−5	−16	−10.7	10	W. 2	0	0	0	0	NW. 2	NW. 2	W. 2	....	....	....	Cloudy and cold; clear and cold; clear and very cold.
5	.726	.612	.489	.609	−10	6	4	0	0	0	0	0	0	0	W. 2	NW. 4	N. 3	....	....	....	Clear; river frozen; clear and moderating; clear, wind very cold.
6	.499	.486	.329	.438	12	26	16	18	0	0	10	SW. 2	10	SW. 3	WSW. 1	SW. 2	0	....	....	....	Clear; hazy; overcast and hazy.
7	.262	.265	.357	.295	31	36	36	34.3	10	SW. 3	10	SW. 3	0	0	SW. 3	SW. 3	SW. 4	....	....	....	Hazy, thawing; overcast, hazy; clear; wind warm.
8	.103	26.991	26.982	.025	42	52	46	46.7	10	SW. 3	10	SW. 3	8	SW. 5	SW. 3	SW. 3	SW. 3	....	....	....	Hazy and warm; hazy, wind warm; clouds breaking away.
9	26.933	.942	27.032	26.969	42	49	40	43.7	0	0	0	0	10	SW. 3	SW. 5	SW. 5	SW. 4	....	....	....	Clear, sun warm; clear, and no snow on the ground; hazy and overcast.
10	27.316	27.302	.181	27.266	31	44	38	37.7	5	SW. 3	0	0	10	SW. 4		SW. 4	SW. 4	....	....	....	Hazy and warm; clear; hazy.
11	26.732	26.498	26.879	26.703	41	46	−2	28.3	10	SW. 4	10	SW. 4	10	NW. 3	SW. 3	SW. 5	W. 4	9 p. m.	Night....	.330	Clear; warm; hazy, wind heavy; snow 1½ inches.
12	27.285	27.435	27.541	27.420	−9	−6	−16	−10.3	10	0	5	W. 2	0	0	NW. 4	NW. 3	0	....	....	....	Clear, cloudy, cold; clear, cold; clear, cold.
13	.440	.392	.392	.408	−20	−10	−10	−13.3	10	0	10	0	10	0	NE. 2	NE. 2	NE. 2	....	....	....	Cold; river closed; snowing slowly; snowing a little.
14	.343	.258	.265	.289	−17	−10	−27	−18	2	SWW. 3	2	W. 3	0	0	W. 1	W. 3	W. 1	....	....	....	Clear, ½ inch of snow last night; cold, wind sharp; clear and cold.
15	.285	.248	.249	.261	−16	2	−9	−2.3	0	0	0	0	0	0	NW. 2	W. 3	W. 1	....	....	....	Clear; clear, moderating; clear, cold.
16	.165	.170	.182	.172	−5	12	−7	0	0	0	0	0	0	0	SWW. 4	W. 1	W. 1	....	....	....	Clear; clear and moderating; clear.
17	.249	.293	.360	.301	−4	−1	−10	−5	10	N. 2	10	0	0	0	N. 2	NE. 2	N. 1	....	....	....	A little snow falling; overcast, cold wind; hazy.
18	.433	.398	.371	.401	−18	−11	−16	−15	10	0	5	0	10	0	NW. 3	NW. 2	NE. 3	9 p. m.	Night....	.162	Cl'dy; hazy; snowing slowly. (½ inch.)
19	.384	.364	.330	.359	−19	−11	−24	−18	5	0	0	0	0	0	0	W. 2	W. 3	....	....	....	Cold, frosty; clear, sun warm; clear, very cold.
20	.254	.232	.272	.253	2	6	8	5.3	10	0	5	0	10	0	WSW. 4	W. 5	W. 4	....	....	....	Hazy; clouds and sun alternately; overcast.
21	.386	.397	.494	.426	−11	−6	−15	−10.7	10	0	10	0	0	0	NE. 2	ENE. 2	WSW. 3	....	....	....	Cl'ds heavy; a little snow falling; hazy.
22	.523	.462	.443	.476	4	18	16	12.7	0	0	0	0	0	0	SW. 4	SW. 5	SW. 5	....	....	....	Clear; clear, sun warm; clear, wind heavy.
23	.422	.434	.372	.409	9	14	2	8.3	2	0	10	0	10	0	0	NE. 2	NE. 1	....	....	....	Clear; overcast, cool; overcast, heavy and dark.
24	.266	26.979	26.879	.039	−10	−2	−2	−4.7	10	0	10	0	10	0	NE. 1	NE. 1	NE. 2	4 p. m.	9½ p. m.	.540	Overcast, light; clearing off at 9; overcast; snow, 2.5 inches.
25	.033	27.058	27.126	.072	9	27	16	17.3	10	0	7	SW. 3	0	0	NE. 1	SW. 3	SW. 2	....	....	....	Overc't; cld's & sun alternately; clear.
26	.302	.334	.336	.324	17	35	30	27.3	0	0	1	0	5	NW. 1	SW. 3	SW. 3	SW. 4	....	....	....	Clear; clear and warm; clear, clouds heavy in N.
27	.223	.075	.020	.102	37	44	43	41.3	10	0	10	0	0	0	SW. 6	SW. 6	SW. 6	....	....	....	Overc't, heavy; overc't, warm; hazy.
28	.395	.394	.332	.374	36	53	40	43	6	NW. 2	2	W. 2	0	0	SW. 1	SW. 3	SW. 1	....	....	....	Clouds heavy in NE.; clear, warm, no snow; clear.
29	.260	.315	.348	.308	49	54	40	47.7	0	0	5	SW. 3	0	0	SW. 3	SW. 5	SW. 2	....	....	....	Clear; clear and warm; clear, warm.
30	.192	.098	.102	.131	53	61	54	56	10	SW. 1	10	0	10	0	SW. 6	SW. 6	SW. 3	....	....	....	Overcast, dark; cloudy, warm; clearing up at 6; overcast.
31	26.949	26.916	.194	26.996	58	60	26	48	5	SW. 2	3	SW. 4	10	0	SW. 3	SW. 6	NE. 2	....	....	....	Clear; clear, warm sun; wind from NE. at 5½ p. m.; snow'g at 7; snow all night.
Means..	27.264	27.232	27.245	27.247	13.74	22.52	13.96	16.32	6.03	....	5.65	....	4.93	....	....	....	....	....	....	1.592	

Observations made at Fort Benton, Upper Missouri river, for the month of February, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Feb. 1	27.296	27.400	27.473	27.390	17	24	0	13.7	10	NE. 2	10	SW. 3	0	0	NE. 1	SW. 1	0	....	9 a. m..	1.780	Snowing; clearing up; 4½ inches snow, very damp; clear.
2	.442	.276	.132	.283	10	34	16	20	0	0	0	0	10	0	N. 1	W. 1	NE. 1	....	....	....	Clear; clear, sun warm; hazy.
3	.150	26.965	.045	.053	3	42	28	24.3	0	0	0	0	0	0	0	SW. 1	0	....	....	....	Clear and frosty; clear, warm; clear.
4	.170	27.297	.418	.295	16	33	22	23.7	2	SW. 1	1	0	5	SW. 2	0	SW. 1	SW. 1	....	....	....	Clear; clear, warm; cloudy partially.
5	.418	.282	.240	.313	17	34	17	22.7	10	0	0	0	0	0	0	SW. 1	0	....	....	....	Frosty; clear; clear.
6	.250	.121	.056	.142	−2	42	40	26.7	6	0	0	0	0	0	0	SW. 2	SW. 4	....	....	....	Frosty; clear and warm; clear.
7	.327	.137	.074	.179	24	37	36	32.3	0	0	0	0	0		0	0	SW. 4	....	....	....	Clear; clear and warm; clear.
8	26.955	26.907	26.917	26.926	42	47	39	42.7	10	0	10	NW. 1	5	W. 4	SW. 6	SW. 6	WSW. 3	....	....	....	Overcast; overcast, very dark; clear, fine night.
9	27.097	27.044	.965	27.035	28	35	29	30.7	10	0	10	SW. 1 SW. 2	6	0	NE. 2	NE. 2	N. 3	....	....	....	Cloudy; hazy and cool; cloudy, wind cold; partially cloudy.
10	26.893	26.796	.702	26.797	20	36	27	27.7	5	SW. 2	6	SE. 1	0	0	0	NE. 1	0	....	....	....	Clear and frosty; sunshine occasionally; clear.
11	.622	.795	.928	.782	17	18	8	14.3	10	N. 3	10	0	1	SW. 3	N. 3	NW. 3	N. 2	10 a. m..	11 a. m..	.170	Overcast, heavy; cloudy, dark; snow at 10 (1 inch;) clear.
12	27.157	27.095	27.005	27.086	−6	10	4	2.7	0	0	0	0	0	0	0	N. 2	NW. 4	....	....	....	Clear; clear; clear.
13	26.997	.085	.369	.150	−3	14	−5	2	10	0	10	0	8	0	N. 1	NE. 2	NE. 3	....	....	....	Overcast, light; overcast, dark; clearing off.
14	27.525	.473	.407	.468	−1	6	3	2.7	7	0	10	0	0	0	NE. 1	N. 1	0	....	....	....	Cloudy; overcast, heavy; clear, growing cold.
15	.313	.276	.274	.288	4	27	13	14.7	10	0	5	0	8	0	NE. 1	0	0	....	....	....	Overcast, heavy; sunshine occasionally; clouds heavy.
16	.425	.294	.236	.318	0	26	17	14.3	0	0	0	0	0	0	N. 1	0	0	....	....	....	Clear; clear; clear and calm.
17	.212	.162	.166	.180	21	46	31	32.7	5	0	5	SW. 2	0	0	0	SW. 4	0	....	....	....	Clouds light; clear, sun warm; clear and calm.
18	.173	.093	.106	.124	28	39	32	33	0	0	1	0	0	0	0	SW. 2	0	....	....	....	Hazy; wind warm; clear.
19	.196	.117	.141	.151	22	57	33	37.3	3	0	1	0	0	0	0	SW. 2	0	....	....	....	Hazy; warm; clear.
20	.134	.102	.177	.138	31	49	34	38	10	0	3	0	6	0	SW. 3	SW. 1	0	....	....	....	Overcast; hazy, warm; cloudy, calm.
21	.341	.267	.442	.350	29	50	31	36.7	0	0	0	0	0	0	0	SW. 2	0	....	....	....	Clear and calm; clear and warm; clear, calm.
22	.368	.180	.160	.236	18	52	40	36.7	0	0	10	0	0	0	0	SW. 4	SW. 5	....	....	....	Clear; overcast, hazy; clear and warm.
23	.156	.145	.226	.176	39	43	35	39	10	0	10	0	0	0	SW. 4	SW. 1	SW. 3	....	....	....	Overcast, heavy; overc't, hazy; clear.
24	.373	.321	.390	.361	32	42	30	34	10	0	8	SW. 1	0	0	0	0	0	Night ...	Night ...	.140	Overcast, 1 inch snow in night; cl'dy, warm; clear.
25	.292	.110	.036	.146	19	49	30	32.7	0	0	2	SW. 1	0	0	0	0	0	....	....	....	Clear and frosty; clear; clear, river breaking up.
26	.028	.036	26.995	.119	40	49	32	40.3	8	SW. 3	10	0	0	0	SW. 2	SW. 2	0	....	....	....	Cl'dy and hazy; cl'dy and warm; clear.
27	.045	26.999	27.018	.021	33	52	32	39	10	0	6	SW. 1	0	0	0	SW. 3	0	....	....	....	Cloudy, dark, cool; clear and cloudy; clear.
28	.024	.999	.116	.046	26	37	30	31	9	0	10	0	10	0	NE. 1	N. 3	NE. 2	2 p. m...	....	1.320	Cloudy and hazy; snow and rain; snowing slowly (3 inches.)
Means..	27.192	27.135	27.150	27.159	18.71	36.79	24.43	26.63	5.54	....	4.86	....	2.04	....	....	....	....	....	....	3.410	

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Observations made at Fort Benton, Upper Missouri river, for the month of March, 1854, (observed by Assistant Lint from Mar. 21 to April 6.)

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Rain and melted snow.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	P. M.	Hour began.	Hour ended.	Amo'nt, inches.	
Mar. 1	27.285	27.320	27.383	27.336	21	36	10	22.3	10	0	6	0	0		NW. 2	SW. 1	0	28 ult., 2 p. m.	1 p. m...	1.630	Snow'g slowly; snow and rain ceased 1 p. m. (4½ in. in all;) clear and frosty.
2	.275	.198	.210	.228	15	38	30	27.7	1	SW. 1	0	0	4	NE. 2	W. 1	WSW. 2	SW. 3	....	....	....	Clear; clear; cloudy in NE.
3	.267	.250	.230	.249	28	54	21	34.3	10	0	2	SW. 1	0	0	NE. 1	SW. 1	0	....	....	....	Overcast, dark; clear, thawing fast; clear and cool.
4	.227	.166	.210	.201	18	50	22	30	9	SW. 2	3	0	6	0	0	N. 1	NE. 1	....	....	....	Cloudy and cool; clear, sun very warm; cloudy, heavy in NE.
5	.252	.261	.328	.280	23	55	26	31.7	10	0	5	0	10	0	NW. 1	SW. 1	NE. 1	....	....	....	Overcast, heavy; cl'ds and sun, a little snow at 7 a. m. to 9; overcast, hazy.
6	.302	.197	.239	.246	12	56	28	32	10	NE. 1	0	0	0	0	NE. 1	0	0	....	....	....	Cloudy, dark; clear, warm; clear.
7	.080	26.670	.246	26.999	29	40	40	36.3	5	0	10	0	10	0	0	SW. 4	SW. 6	....	....	....	Hazy; overcast, wind cold; overcast, very hazy.
8	26.886	.955	.162	27.001	35	50	32	39	10	0	10	0	10	0	E. 1	W. 3	SWW. 1	....	....	....	Overcast, heavy; ditto, few flakes of snow at noon; overcast.
9	27.305	27.128	.018	.150	22	48	45	38.3	0	0	10	0	10	0	0	W. 2	WSW. 6	....	....	....	Cl'r; overc't, dark; overc't, light, hazy.
10	26.725	26.894	.007	26.875	46	48	33	42.3	5	0	10	0	2	WNW. 5	SW. 6	WNW. 6	W. 6	....	....	....	Warm, cl'ds light; overc't, heavy, few drops of rain 1 p. m; cl'r, high wind.
11	27.140	27.101	.063	27.101	30	40	27	32.3	5	SW. 1	3	SW. 2	0	0	SW. 1	N. 1	0	....	....	....	Clouds light, warm and hazy; clear, warm; clear and calm.
12	.008	26.889	26.902	26.933	30	44	30	34.7	1	0	0	0	0	0	W. 3	W. 4	0	....	....	....	Clear; clear, wind cool; clear & cool.
13	.015	27.035	27.054	27.035	33	47	32	37.3	4	SW. 1	10	0	0	0	SW. 5	SW. 1	NE. 1	....	....	....	Cl'ds light; overc't, hazy, warm; hazy.
14	26.968	26.850	26.819	26.879	40	50	42	44	3	0	8	SW. 1	10	0	SW. 6	SW. 7	SW. 6	....	....	....	Clear, clouds heavy, strong cold wind; overcast.
15	.861	.909	.941	.905	44	54	40	46	1	SW. 1	1	SW. 2	1	0	SW. 5	SW. 6	NW. 1	....	....	....	Clear and cool; clear & warm; clear.
16	.944	27.096	27.349	27.130	49	49	24	40.7	3	NW. 2	0	0	10	0	W. 5	NW. 6	NE. 3	....	....	....	Clear and warm; clear, cold wind; overcast, wind cold.
17	27.286	.286	.243	.272	26	54	37	39	0	0	0	0	10	0	N. 1	N. 1	0	....	....	....	Cl'r, cool; cl'r, very warm; cl'dy, calm.
18	.168	.224	.275	.222	36	61	37	44.7	10	0	1	0	0	0	0	N. 1	0	....	....	....	Overcast, heavy, cool; clear and very warm; clear, cool, calm.
19	.309	.124	.072	.168	36	71	45	50.7	0	0	0	0	0	0	N. 1	N. 1	0	....	....	....	Clear; clear and warm; clear.
20	.008	26.908	26.937	26.951	43	70	52	55	0	0	1	0	10	0	0	0	NW. 4	....	....	....	Cl'r, warm; cl'r, very warm; overc't.
21	.191	.970	27.282	27.148	47	60	40	49	0	0	0	0	1	0	0	NW. 2	NW. 1	....	....	....	Clear, warm; clear; clear and warm.
22	.371	27.299	.160	.277	60	66	44	56.7	3	0	0	0	0	0	NW. 2	NW. 3	NW. 1	....	....	....	0; clear and warm; 0.
23	.333	.284	.356	.324	46	56	41	47.7	4	0	8	0	10	0	SW. 1	SW. 1	NE. 3	....	....	....	0; hazy; 0.
24	.331	.307	.308	.315	35	45	40	40	10	NE. 2	8	NE. 3	4	0	NE. 2	NE. 3	NE. 3	....	....	....	Few flakes of snow, melts as it falls; wind cold; 0.
25	.296	.300	.301	.299	34	33	29	32	10	NW. 4	10	0	10	0	NW. 4	NE. 4	NE. 2	10 a. m..	8 p. m...	.765	Few flakes snow; snow, 10 a. m.; snow ceased at 8 p. m., melted as it fell.
26	.344	.289	.457	.363	21	22	19	20.7	10	0	8	0	8	0	NW. 2	NW. 3	NE. 5	7 a. m.. 3 p. m..	10 a. m.. 10 p. m..	.875	Snowing; snow ceased at 10 a. m.; snowing slowly.
27	.358	.203	.169	.243	16	30	28	24.7	8	0	5	0	2	0	NE. 5	N. 4	N. 1	....	....	....	Wind cold; wind cold, sun warm; moderating.
28	.355	.420	.440	.405	21	24	14	19.7	10	0	8	0	10	0	NE. 2	NE. 2	NW. 2	5 p. m...	11 p. m..	.150	Appearance of snow; ditto; snow at 5 p. m., and now snowing.
29	.331	.151	.161	.215	12	30	20	20.7	10	0	8	0	10	0	NW. 2	NW. 1	NW. 1	....	....	....	Very little snow fell (1½ inch;) clouds light; 0.
30	.365	.150	.256	.257	19	34	20	24.3	5	0	4	0	0	0	NW. 1	NW. 2	NW. 1	....	....	....	Clouds running NE.; wind cool; clear.
31	.483	.563	.519	.522	20	27	21	22.7	5	NW. 1	8	0	0	0	NW. 1	NW. 2	NW. 1	....	....	....	Clouds light; snow 10 to 11 a. m; clear.
Means..	27.192	27.141	27.191	27.174	30.65	46.52	31.36	36.18	5.55	....	4.6	....	4.77	....	....	....	....	....	....	3.240	

Observations made at Fort Benton, Upper Missouri river, for the month of April, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Hygrometer.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
April 1	27.537	27.471	27.196	27.402	42	52	45	46.3	0	—	4	—	10	—	W. 1	SW. 3	SW. 2	......	40	......	Sunshine; warm; 2 p. m., cloudy; warm; 9 p. m., cloudy.
2	26.951	26.922	26.993	26.955	56	70	51	59.0	8	—	5	—	10	—	W. 5	SW. 5	SW. 3	......	54	......	Warm; cloudy and hazy; 2 p. m., warm; 9 p. m., warm.
3	27.164	27.322	27.274	27.253	54	66	49	56.3	5	—	3	—	3	—	SW. 3	W. 4	0	......	49	......	
4	.288	.148	.120	.185	59	73	62	64.7	8	—	8	—	6	—	W. 4	W. 5	W. 2	......	56	......	Overcast.
5	.142	.302	.353	.266	55	62	46	54.3	8	—	3	—	10	—	SW. 3	W. 5	0	......	48	......	
6	.334	.297	.415	.349	46	58	34	46.0	4	—	3	W. 2	2	NW.	0	NW. 3	N. 1	......	......	......	Warm and hazy.
7	.414	.440	.457	.437	54	51	38	47.7	0	—	2	W. 1	0	—	N. 2	N. 2	SW. 2	......	......	......	
8	.446	.386	.325	.386	53	61	42	52.0	0	—	—	—	—	—	SE. 1	—	—	......	......	......	
9	.255	.072	26.972	.100	55	68	51	58.0	0	—	0	—	0	—	0	SW. 2	—	......	......	......	
10	26.949	26.982	.986	26.972	63	69	47	59.7	0	—	0	—	0	—	—	S. 1	—	63	59	......	Clear and warm.
11	27.020	.935	27.026	.960	41	67	47	51.7	10	—	9	S. 1	10	—	—	SE. 1	NE. 3	41	66.5	......	A few drops of rain.
12	.030	27.258	.308	27.199	38	61	40	46.3	0	—	5	W. 2	0	—	SW. 2	SW. 1	N. 1	39	60	30	
13	.329	.315	.375	.339	47	66	50	54.3	2	W. 3	3	WSW. 1	5	—	WNW. 4	SW. 6	—	38	49	......	Clear and cool.
14	.518	....	.421	....	47	70	50	55.7	0	—	0	—	0	—	—	—	W. 1	......	......	49.5	
15	.393	.238	.058	.240	49	81	51	60.3	0	—	0	—	0	—	—	SW. 1	—	35	69.2	47	Clear and warm.
16	.034	26.968	26.970	26.991	64	76	57	65.7	3	—	3	SW. 1	—	—	SW. 3	SW. 6	—	49	54	48	
17	.086	.943	.986	27.005	51	73	53	59.0	0	—	10	—	—	—	—	SW. 3	—	......	51.2	43.5	
18	26.974	.794	.788	26.852	51	85	65	67.0	4	—	10	—	—	—	SW. 1	SE. 1	SW. 2	48	59	51.5	6 p. m., violent gale, lasting ten minutes.
19	.811	.832	.921	.855	52	69	57	59.3	10	—	10	—	—	—	—	SW. 1	—	47.5	51	41	
20	27.068	.884	.893	.948	45	66	53	54.7	0	—	10	—	10	—	N. 1	NW. 3	NE. 2	38.5	49	48	Hazy.
21	26.892	.812	.871	.858	40	66	46	50.7	10	—	9	—	10	—	SE. 2	S. 2	NNW. 4	40	48.8	44.8	Commenced raining at 5 p. m.; ceased at 7 p. m.
22	27.116	27.198	27.229	27.181	50	53	44	49.0	10	—	10	—	—	—	NW. 3	NE. 3	N. 1	46	48	42	
23	.222	.246	.214	.227	54	51	46	50.3	10	—	10	—	10	—	SE. 1	N. 1	SE. 1	42.5	48.5	42.5	
24	.205	.135	.070	.137	42	62	51	51.7	10	—	10	—	10	—	E. 1	SE. 1	E. 3	41	49	47	Overcast; cool and damp.
25	.010	.069	26.992	.024	50	57	56	54.3	5	—	10	—	10	—	SW. 1	NE. 2	E. 1	48	50	50	Slight shower at m. and 1½ p. m.
26	.186	.224	27.305	.238	52	64	52	56.0	10	—	2	SW. 1	10	—	S. 1	SW. 1	NE. 2	48	53.5	51.5	Commenced raining at 8 p. m.
27	.420	.454	.448	.441	42	57	48	49.3	10	—	10	—	—	—	SE. 2	SW. 3	—	48	48.5	43.5	Ceased in night; 0.400 of an inch fell.
28	.486	.431	.364	.427	48	62	55	55.3	10	—	1	—	0	—	S. 1	SW. 1	W. 4	45.5	53.5	48	7 a. m., overcast; damp and cool; 2 p. m., clear and warm.
29	.310	.200	.198	.236	51	69	61	60.3	1	N. 1	1	N. 1	—	—	NE. 3	N. 3	N. 4	47.5	55	50	7 a. m., warm.
30	.287	.254	.259	.267	57	68	58	61.0	8	N. 1	2	NE. 4	—	—	NE. 1	NE. 4	NE. 3	52	51.5	47	Clear; wind cool.
Means..	27.203	27.150	27.162	27.172	50.33	64.87	50.40	55.20	....	....	....	....	....	....	....	....	....	......	.....	......	

Observations made at Fort Benton, Upper Missouri river, for the month of May, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Hygrometer.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	7 A. M.	1 P. M.	9 P. M.	
May 1	27.322	27.225	27.180	27.242	52	72	61	61.7	0	—	0	—	0	—	NE. 5	NE. 5	NE. 6	45.3	52.5	48.2	7 a. m., clear, wind cool; 2 p. m., hazy; 9, clear, high wind.
2	.198	26.971	.050	.040	54	84	57	65.0	—	—	6	SE. and NE. 2	3	SW. 2	SE. 1	SE. 1	SW. 1	52.5	66.8	50.5	7 a. m., clear and warm; 2 p. m., sultry; 9 p. m., clear.
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
4	.192	27.079	26.926	.066	54	78	68	66.7	8	—	8	—	5	NE. 2	SE. 1	SE. 1	NE. 6	47	......	52	7 a. m., hazy; 2 p. m., sultry; 9 p. m., high wind.
5	.028	26.996	27.021	.015	49	71°	53	57.7	10	—	10	—	10	—	NE. 2	NE. 1	NE. 3	43.6	56	......	7 a. m., overcast; cool wind. 2 p. m.; overcast, 9 p. m.; commenced raining at 8¼ o'clock.
6	26.972	.939	26.928	26.947	50	49	45	48.0	10	—	10	—	10	—	NE. 3	NE. 4	NE. 2	47.3	46	45	7 a. m., overcast and very dark; still raining; 1.160 inches rain last night.
7	.910	.981	27.059	.991	35	39	34	36.0	10	—	10	—	9	NW. 3	NW. 2	NW. 2	NW. 5	35	36.5	......	Snowing and raining; ceased at 11 o'clock.
8	27.100	27.141	.180	27.140	39	44	41	39.0	10	NW. 4	10	NW. 3	6	NW. 4	NW. 3	NW. 3	NW. 5	31	39.5	37.5	1 inch snow last night; 9 a. m., snowing.
9	.291	.21·	....	....	44	59	......	......	10	NW. 4	3	W. 3	—	—	NW. 3	SW. 4	—	41	50.5	....	Cloudy and cool; 9 p. m., clear.
10	.203	.134	.139	.159	47	56	47	50.0	10	E. 2	9	NW. 4	0	—	NE. 1	NW. 4	—	......	49.5	44	Overcast; 9 p. m., clear; shower at 3 p. m.
11	.072	26.940	26.988	.007	52	67	50	56.3	1	—	5	NW. 3	4	E. 1	W. 1	NE. 3	E. 2	46.5	59	46.5	Clear and cool; 9 p. m., cool; shower at 5 p. m.
12	26.976	27.015	27.068	.020	45	63	45	51.0	2	W. 1	4	—	2	—	—	W. 3	—	41	53	43	
13	27.153	.075	.168	.132	44	63	51	52.7	10	—	2	E. 2	9	—	—	E. 4	E. 3	42	53.5	45	Cool and cloudy; 9 p. m., ditto.
14	.259	.263	.306	.276	52	69	51	56.0	2	—	1	E. 1	—	—	E. 2	E. 2	E. 3	45	49.5	44	Clear and cool.
15	.335	.302	.296	.311	44	65	54	54.3	1	—	1	E. 2	3	—	—	E. 4	—	40	50	46.5	Clear.
16	.333	.249	.243	.275	52	73	62	62.3	0	—	1	—	1	—	—	—	—	46.5	61	54.5	Clear and warm.
17	.299	.172	.184	.219	60	76	60	65.3	1	—	2	NW. 2	1	—	—	NW. 3	—	50.5	57	50	Clear and warm.
18	.404	.317	.244	.322	60	73.5	69	67.5	1	—	1	—	1	—	—	—	—	50.5	57.5	51	Warm and sultry.
19	.359	.350	.374	.361	63	74	57.5	64.8	2	NE. 1	2	NE. 1	0	—	NE. 1	NE. 2	—	50	60	49	Warm and clear.
20	.302	.223	.178	.235	59	72.5	66	65.8	1	E. 1	1	SE. 2	4	—	E. 2	SE. 4	E. 5	50	55	51.5	Hazy; 2 p. m., clear.
21	.197	.118	.118	.144	63	81.5	64	69.5	1	—	1	—	1	—	—	—	—	55	61.5	53.5	Clear and warm.
22	.164	.085	.066	.106	69	87.5	66	74.2	—	—	—	—	—	—	—	—	—	55	61	55.5	Very clear.
23	.192	.134	.158	.161	61.5	81.	61	67.8	9	—	2	NE. 1	—	—	—	NE. 3	—	53	63	55	Cloudy; 2 p. m., clear and warm.
24	.177	26.918	26.902	.000	59	89	73.1	72.2	—	—	—	—	10	—	—	E. 2	NW. 3	45	61.5	53.5	Clear and cool.
25	....	....	....	....	54.5	66	54.5	58.3	9	—	5	—	1	—	—	—	NE. 3	47.5	53	45	Cool and cloudy.
26	.214	27.112	27.072	.133	52	61	55	56.0	2	—	2	—	1	—	SE. 7	SE. 5	NE. 3	44	50	46	Almost total eclipse of the sun 3¾ p. m.
27	.068	26.914	26.897	26.960	54	74	63	63.7	1	S. 1	1	E. 1	9	—	SE. 4	SE. 3	—	49.5	53.5	56	Windy.
28	....	27.188	27.232	....	51	53.5	48	50.8	10	—	10	—	10	—	—	NE. 3	—	44	44.5	44.0	Overcast; cool.
29	.160	....	.013	....	45	......	58.5	......	9	—	—	—	6	—	—	—	—	42	......	51.5	Cloudy and cool.
30	26.962	26.910	26.877	.916	50	55.5	47	50.8	10	E. 3	10	NE. 3	1	—	NE. 3	N. 6	—	49	50.5	45.5	Overcast and cool.
31	27.101	27.129	27.102	27.111	52	63	54.5	56.5	10	NW. 2	7	—	—	—	W. 3	—	—	45	56	49.5	Hazy and dark; slight showers during the day.
Means.	27.173	27.111	27.103	27.129	51.73	67.34	55.82	58.30	....	....	....	....	....	....	....	....	....	46.0	54.0	48.7	

Observations made at Fort Benton, Upper Missouri river, for the month of June, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.						Wind, direction and force.			Hygrometer.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
June 1	27.358	27.112	27.134	27.201	49	77	59	61.7	0	0	0	0	10	0	0	SE. 4	0	46	56.5	57	Clear and warm; 9 p. m. cloudy, and sharp lightning.
2	.143	.090	26.990	.074	62	71	60	64.3	1	0	6	0	5	0	0	0	0	55	63	55	Heavy shower of rain and hail last night; hazy and warm.
3	.123	.097	27.091	.104	57	68	57	60.7	10	NW. 1	10	NW. 2	9	NW. 1	0	0	W. 1	54.5	61.5	55	Overcast, warm and sultry; 9 p. m. cool & cloudy.
4	.149	.097	.168	.138	62	73	64	66.3	8	W 1	7	W. 1	8	0	W. 3	SW. 2	0	54	61	58	Cloudy.
5	.306	.290	.323	.306	58	61	57	58.7	10	0	10	NE. 1	10	0	0	SE. 2	0	53	59	56	Raining: .450 of an inch fell.
6	.340	.234	.200	.258	63	72	63	66.0	1	SE. 2	0	0	0	0	NE. 3	SE. 7	SE. 5	56	50	60	Clear and cool.
7	.114	.005	.079	.066	61	75.5	72	69.5	1	0	1	SE. 1	1	0	0	SE. 5	0	50.5	55	63	Hazy and cool.
8	.185	.271	.179	.212	63	71	65	66.0	3	0	1	0	2	0	SW. 1	0	0	58	63	60	Hazy and cool; 9 p. m. clear and cool.
9	.276	.236	.262	.258	63	82	62	69.0	1	0	1	0	0	0	0	0	0	68.5	64	58	Clear and warm.
10	.323	.273	.298	.298	65.5	82	62	69.8	8	0	7	0	4	0	0	0	0	59	66	58	Cloudy and warm.
11	.308	.198	.189	.232	66	82	66	71.3	4	0	1	0	4	0	0	0	0	60	65.6	59	Clear and warm; 9 p. m. clear and cool.
12	.189	....	.054	.122	66	......	69	67.5	5	0	0	0	3	0	0	0	0	62	......	65	Clear and warm; 9 p. m. clear and cool.
13	.071	.049	.038	.053	63	81	70	71.3	4	0	5	0	10	0	0	0	W. 2	60	71.5	62	Clear and warm; 9 p. m. overcast and dark.
14	.065	.006	26.997	.023	73	89	66.5	76.2	1	0	5	0	10	0	0	0	0	64.5	67	64	Clear and warm; 9 p. m. overcast and dark.
15	26.936	26.880	.912	26.909	64	70	56	63.3	10	0	10	NW. 3	10	0	0	NW. 4	W. 6	60.5	62.5	54.5	Fine rain all day.
16	27.077	27.103	27.196	27.125	55	63	54	57.3	10	0	9	N. 1	1	0	0	0	NW. 1	53	57	52.5	Overcast, cool.
17	.190	.111	.072	.124	55	75	65	65.0	0	0	1	0	1	0	W. 1	0	W. 2	50.5	63.5	55.5	Very clear.
18	.074	.012	.030	.016	64	74	60.5	65.2	9	0	1	0	0	0	W. 1	W. 1	0	57	62.5	55	Cloudy; 2 p. m. clear and warm; 9 p. m. clear and cool.
19	.124	.113	26.731	26.989	55	68.5	57	60.2	10	0	9	0	3	W. 3	0	0	W. 1	51	55.5	49	Cloudy; 2 p. m. clear and warm; 9 p. m. clear and cool.
20	.253	.236	27.203	27.231	60	76	65	67.0	5	W. 2	0	0	10	E. 4	NW. 2	NW. 2	NE. 3	40.5	58.5	52	Clear; 2 p. m. clear and warm; 9 p. m. overcast.
21	.302	.056	26.820	.059	72	80	75	75.7	4	0	1	0	10	0	0	NE. 9	NE. 7	50.5	62	58	Hazy, sultry; rain and thunder at 6 p. m.
22	.196	.161	27.133	.163	67	80	65	70.7	3	W. 1	1	0	10	0	SW. 5	SW. 6	E. 1	53	57	53	Hazy, sultry; rain and thunder at 6 p. m.
23	.262	.190	.186	.213	68	86	73	75.7	9	SW. 3	2	N. 1	3	E. 1	NE. 1	NE. 1	0	53.5	65	61	Warm; 2 p. m. clear; 9 p. m. hazy and sultry.
24	.221	.053	.047	.107	71	89.5	77	79.2	0	0	10	SE. 2	10	SE. 3	0	NE. 2	SE. 3	60.5	69	61.5	Clear and warm; 9 p. m. overcast, storm coming from E.
25	.061	26.993	.055	.036	72	83	68	74.3	1	0	10	E. 2	8	NE. 3	SW. 3	SW. 4	0	63.5	61	54	Clear and warm; 9 p. m. overcast, storm coming from E.
26	.085	.997	.090	.057	63	77	64	68.0	10	E. 1	10	SE. 2	10	0	NW. 1	SE. 1	SE. 1	48.5	57.5	49	Overcast, warm; white squall at 6 p. m.
27	.261	27.268	.245	.258	62	77	65	68.0	2	SW. 1	0	0	0	0	SW. 4	SW. 3	SE. 2	48	54.5	52.5	Clear and cool.
28	.285	.138	.113	.179	66	87	70	74.3	0	0	2	W. 3	0	0	0	S. 2	0	56	64	59	Clear.
29	.094	26.892	26.921	26.969	60	91	73	73.7	7	SE. 3	5	S. 1	10	E. 3	0	S. 1	SE. 3	52	66.5	52	Cloudy; 2 p. m. clear; 9 p. m. appearance of rain.
30	26.867	.878	.990	.912	67	76	60	67.7	3	SW. 3	4	SW.	2	W. 1	W. 4	W. 5	W. 5	52.5	55	43	Clear.
Means.	27.170	27.104	27.097	27.124	63.1	77.2	64.7	68.3	....	....	....	....	....	....	....	....	....	55.7	61.1	56.7	

NOTE.—The attached thermometer readings were identical with those recorded as "open air." There were no observations of amount or exact time of rain in most cases.

Observations made at Fort Benton, Upper Missouri river, for the month of July, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.									Wind, direction and force.						Hygrometer.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.			2 P. M.			9 P. M.			7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	
July 1	27.025	27.067	27.166	27.093	62	73	59	64.7	0	0		1	SW.	4	0	0		SW.	6	SW.	6	0		40.5	51	43.5	Clear, warm; 2 p. m., clear; 9 p. m., cool.
2	.203	.067	.132	.141	71	79	67	72.3	6	0		3	E.	1	7	S.	2	S.	1	NE.	1	NW.	1	53.5	58	51	Hazy; 9 p. m., growing cool.
3	.215	.161	.160	.179	67	79	64	70.0	5	SW.	2	3	SW.	3	2	SW.	2	SW.	5	SW.	5	0		52	55	48.5	Clear.
4	.168	.113	....	....	72	85	......	.....	2	SW.	3	2	SW.	3	0	0		SW.	4	SW.	3	0		53.5	......	.....	Clear and warm.
5	.180	.057	.011	.083	82	87	73	80.7	0	0		0	0		5	SW.	3	SW.	1	NW.	2	SW.	1	......	71	51.5	Clear and warm.
6	.050	.097	.322	.156	64	53	44	53.7	2	0		10	NE.	3	0	0		N.	1	NE.	5	NW.	4	54	47	39.5	Clear; 2 p. m., overcast; 9 p. m., clear.
7	.432	.466	.489	.462	49	57	51	52.3	10	E.	2	10	E.	1	0	0		NW.	1	NW.	1	0		47	54	47.5	Cold, raining; 2 p. m., overcast; 9 p. m., clear.
8	.571	.372	.488	.477	60	78	66	68.0	0	0		0	0		3	SE.	1	N.	1	NW.	1	NW.	1	53	58	59	Clear and warm.
9	.535	.477	.505	.502	72	86	68	75.3	0	0		1	S.	1	0	0		0		W.	1	W.	1	57	64	61	Clear and warm.
10	.496	.309	.294	.366	70	95	71	78.7	1	SE.	1	1	SE.	2	1	SE.	1	NW.	1	NW.	1	0		61	67	66	Clear and warm.
11	.381	.275	.226	.294	76	96	70	80.7	0	0		0	0		0	0		W.	1	NW.	2	0		63	64	62	Clear and warm.
12	.308	.270	.290	.283	71	93	74	79.3	1	E.	1	3	SE.	2	4	SE.	1	W.	1	W.	2	NW.	3	65	69	63	Clear and warm; 9 p. m., breeze from NW.
13	.305	.258	.193	.252	72	90	76	79.3	2	0		2	S.	1	1	NW.	2	NW.	1	NW.	1	SE.	5	62	70	64	Cool wind.
14	.156	.079	26.972	.069	77	80	75	77.3	1	W.	1	3	SE.	1	3	SE.	1	SE.	2	NW.	2	NW.	1	63	66	65	Cool wind from N. W.
15	26.886	.090	.180	.052	76	87	70	77.7	0	0		2	S.	1	3	NW.	1	W.	1	W.	1	SE.	2	63	63	61	Clear and warm; 9 p. m., clear and cool.
16	.145	.148	.277	.190	66	71	60	65.7	2	SE.	1	5	SW.	2	3	N.	1	NW.	2	NW.	3	0		64	62	57	Cool and pleasant.
17	.382	.308	.360	.350	61	74	62	65.7	2	SE.	1	1	E.	3	9	S.	1	W.	1	NNW.	2	NW.	1	57	56	53	Clear and pleasant.
18	.348	.288	.217	.284	66	86	70	74.0	0	0		9	E.	1	0	0		NW.	1	W.	1	W.	1	55	64	56	Clear; cool.
19	.451	.464	.470	.462	51	57	56	54.7	10	SW.	2	8	SE.	1	10	NW.	1	SE.	3	SE.	1	NE.	1	50	55	54	Cool; overcast; 9 p. m., appearance of rain.
20	.403	.346	.248	.332	51	78	70	66.3	7	SW.	1	4	SE.	2	2	SE.	1	NE.	1	W.	1	NW.	3	50	63	53	Cool, and heavy fog; 9 p. m., cool NW. wind.
21	.214	.172	.183	.190	76	94	80	83.3	0	0		1	E.	1	5	E.	1	0		NW.	3	NE.	2	60	64	59	Clear and warm.
22	.635	.297	.249	.304	74	90	78	80.7	3	W.	1	5	E.	2	2	NE.	1	NE.	1	NW	1	NW.	1	61	67	60	Pleasant.
23	.271	.185	.238	.231	84	83	72	79.7	3	NE.	1	4	E.	2	8	NE.	3	N.	1	W.	2	W.	5	64	65	64	About noon thermometer stood at 100°
24	.418	.289	.427	.371	78	88	64	76.7	6	0		1	E.	3	9	E.	2	W.	3	W.	3	NW.	5	62	65	58	Clear and cool.
25	.490	.347	.208	.348	80	90	80	83.3	1	E.	1	0	0		0	0		NW.	1	W.	2	W.	3	61	65	63	Clear and cool; 9 p. m., clear and warm.
26	.188	.186	.222	.199	91	99	82	90.3	0	0		1	E.	1	8	W.	1	W.	1	W.	4	E.	3	61	64	64	Very warm.
27	.258	.085	.243	.195	67	91	71	76.3	5	E.	1	2	E.	2	8	0		W.	1	NW.	4	0		62	66	61	Hazy and warm; appearance of storm.
28	.280	.137	.063	.156	66	93	78	79.0	0	0		0	0		2	E.	1	W.	1	NW.	5	NW.	1	57	63	57	Very warm.
29	.143	.048	.072	.088	76	92	75	83.0	3	E.	1	2	E.	1	3	E.	2	W.	1	W.	4	W	1	61	62	60	Cool in morning; very warm at 2 p. m.; cool evening
30	.253	.270	.208	.220	60	72	63	65.0	10	E.	1	8	E.	1	0	0		NW.	1	W.	1	W.	1	55	62	56	Overcast; 9 p. m., clear and cool.
31	.190	.278	.321	.263	67	79	64	70.0	0	0		1	W.	2	0	0		W.	1	SW.	4	W.	1	......	......	55	Clear and cool; 2 p. m., clear and warm; 9 p. m., clear and cool.
Means..	27.290	27.229	27.249	27.256	69.8	82.7	68.4	73.6	....	....		....	....		....	....		....		....		....		57.6	62.0	57.2	

NOTE.—Attached thermometer identical with that recorded as "open air."

Observations made at Fort Benton, Upper Missouri river, for the month of August, 1854, by James Doty, Esq.

Date.	Barometer corrected.				Open air thermometer.				Clouds, their course and velocity.									Wind, direction and force.						Hygrometer.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.			2 P. M.			9 P. M.			7 A. M.		2 P. M.		9 P. M.		7 A. M.	2 P. M.	9 P. M.	
Aug. 1	27.422	27.283	27.262	27.322	71	88	70	76.3	0	0		0	0		0	0		W.	1	NW.	1	NW.	1	51	62	52	Clear and cool; 2 p. m., warm; 9 p. m., cool.
2	.368	.334	.357	.353	68	86	72	75.3	2	E.	1	3	E.	1	0	0		W.	1	W.	1	NE.	1	53	63	59	Cool morning; 2 p. m., warm; 9 p. m., very warm.
3	.672	.328	.390	.463	70	92	80	80.7	0	0		0	0		1	SE.	1	W.	1	W.	1	NE.	5	54	64	59	Pleasant.
4	.255	.167	.197	.206	66	89	78	77.7	0	0		0	0		0	0		W.	1	W.	2	NE.	2	54	64	61	Pleasant, cool morning; very warm evening.
5	.300	.278	.265	.281	75	81	74	76.7	1	E.	1	8	NE.	2	1	E.	1	W.	1	S.SW.	1	0		59	64	59	Very warm day.
6	.394	.340	....	....	70	96	......	......	0	0		0	0		0	0		E.	1	0		0		55	72	......	Cool morning; 2 p. m., hazy.
7	.350	.197	.173	.240	63	93	70	75.3	8	E.	1	9	E.	1	10	SW.	2	NE.	1	SW.	1	SW.	2	58	62	63	Cool; 2 p. m., warm and cloudy; 9 p. m., little rain.
8	.187	.212	.261	.220	66	76	68	70.0	9	E.	1	8	SW.	1	2	SW.	1	0		SW.	2	SW.	1	61	65	62	Cool and cloudy.
9	.229	.086	.052	.122	66	93	78	79.0	0	0		1	E.	1	1	NW.	1	SW.	1	SW.	1	SW.	3	57	61	58	Cool and pleasant.
10	.012	.057	.091	.053	70	90	76	78.7	5	SW.	1	5	SW.	2	8	SW.	1	SW.	3	SW.	8	SW.	4	57	60	56	Clouds in SW.; 2 p. m., sun warm; 9 p. m., cool and pleasant.
11	.203	.195	.284	.227	78	84	68	76.7	1	NW.	2	2	SW.	1	0	0		SW.	1	SW.	3	0		58	53	54	Clear and cool.
12	.390	.236	.221	.282	67	90	74	77.0	1	W.	1	1	W.	2	0	0		W.	1	W.	4	0		47	61	56	Cool morning; 2 p. m., sun warm; 9 p. m., cool.
13	.262	.213	.216	.231	86	92	77	85.0	1	SE.	1	1	SE.	1	1	E.	1	SW.	2	SW.	3	0		56	61	59	Cool morning; 2 p. m., sun warm; 9 p. m., warm.
14	.672	.538	.472	.561	67	78	71	72.0	2	W.	1	0	0		0	0		W.	1	NW.	1	NW.	4	53	56	54	Cool morning; 2 p. m., cool, no clouds; 9 p. m., clear and cool.
15	.484	.454	.468	.470	74	88	74	78.7	1	W.	1	2	W.	1	1	SW.	1	W.	1	S.	1	SW.	1	54	60	57	Cool morning; 2 p. m., very warm; 9 p. m., clear and warm.
16	.476	.351	.413	.413	80	96	76	84.0	1	SW.	1	1	E.	1	2	S.	1	SW.	2	0		S.	1	53	64	59	Warm morning; 2 p. m., very warm; 9 p. m., very warm.
17	.392	.198	.036	.152	76	96	79	83.7	1	S.	1	5	S.	2	4	E.	1	S.	1	S.	4	E.	1	54	64	63	Cool morning; 2 p. m., very warm; 9 p. m., very warm.
18	.039	26.939	26.949	26.976	77	98	78	84.3	2	E.	1	1	SW.	2	0	0		E.	1	SW.	5	0		57	64	59	Cool morning; 2 p. m., wind from SW.; 9 p. m., clear and warm.
19	26.862	.793	.903	.853	74	93	80	82.3	5	SW.	1	8	NE.	1	5	SW.	1	SW.	1	NE.	2	SW.	2	69	61	57	Cool morning; 2 p. m., very warm; 9 p. m., warm, wind SW.
20	27.038	27.055	27.095	27.063	76	91	74	80.3	4	SW.	2	2	SW.	2	4	SW.	1	SW.	1	SW.	5	SW.	1	58	63	64	Sun very warm; 2 p. m., very warm; 9 p. m., warm, wind SW.
21	.154	.145	.163	.154	76	85	75	78.7	3	SW.	1	9	SW.	1	10	SW.	1	SW.	1	SW.	1	SW.	3	60	65	62	Cool morning; 2 p. m., appearance of rain; 9 p. m., clouds back.
22	.142	.153	.197	.164	73	85	74	77.3	1	SW.	1	3	SW.	2	5	SW.	2	SW.	1	SW.	1	SW.	1	64	67	60	Cool morning; 2 p. m., appearance of rain; 9 p. m., cool.
23	.332	.355	.317	.335	66	54	54	58.0	9	NW.	1	10	E.	3	8	SE.	2	NW.	4	NE.	5	SW.	5	53	52	51	Cool wind, 2 p. m.; began raining 10 a. m.; 9 p. m., cool wind.
24	.225	.215	.240	.227	70	79	63	70.7	0	0		4	SW.	2	0	0		N.	1	SW.	5	0		56	62	55	Clear and cool; 2 p. m., sun warm; 9 p. m., clear and cool.
25	.323	.225	.160	.236	70	81	64	73.7	1	S.	1	2	W.	1	9	SE.	1	SW.	1	W.	3	SE.	2	55	64	62	Clear, 2 p. m.; began raining at 6 p. m., and continued till 8 p. m.
26	.212	.111	.099	.141	72	90	76	79.3	5	NW.	1	3	SW.	2	2	SW.	1	NW.	1	SW.	1	SW.	3	62	62.5	62.5	Clear; 2 p. m., sun very warm; distant thunder.
27	.143	.074	.112	.110	80	92	77	83.0	0	0		2	SW.	1	1	SW.	1	0		SW.	1	0		61	64	67	Clear and pleasant; cool evening.
28	.109	.115	.248	.157	71	90	62	74.3	1	SW.	1	2	SW.	1	2	SW.	1	SW.	1	SW.	1	SW.	1	61.5	67	60	Cool breeze from SW.; cool, pleasant evening.
29	.376	.357	.333	.355	70	80	68	72.7	2	SW.	1	1	SW.	1	0	0		SW.	1	0		SW.	1	60	62	59	Clear and warm; clear and cool.
30	.392	.164	26.992	.183	76	83	76	78.3	9	SW.	1	8	SW.	1	5	SW.	2	SW.	1	SW.	1	SW.	4	58	69	64	Appearance of rain; 9 p. m., cool wind from SW.
31	.001	.066	27.064	.044	72	71	65	69.3	4	SW.	2	8	SW.	3	4	SW.	1	SW.	5	SW.	5	SW.	1	59	59	53	A little rain fell; cool, pleasant evening.
Means.	27.260	27.202	27.198	27.220	72.1	86.6	70.3	76.3	....	....		....	....		....	....		....		....		....		56.5	63.1	59.0	

NOTE.—Attached thermometer identical with that recorded as "open air."

Summary of Barometric and Temperature Observations at Fort Benton.

Date.	Barometric means corrected.				Means and extremes of temperature.						Amount of rain and melted snow.
	7 A. M.	2 P. M.	9 P. M	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	Maximum	Minimum.	
					°	°	°	°	°	°	*Inches.*
September, 1853, (last 7 days)	27.335	27.302	27.309	27.316	56.70	63.00	63.90	60.90	75	51	*1.612
October, 1853	.284	.239	.251	.258	47.13	61.58	50.59	53.07	61	10	0.167
November, 1853	.235	.212	.235	.227	12.90	27.40	18.13	19.48	58	—2	0.301
December, 1853	.218	.193	.197	.203	27.16	41.32	30.32	33.00	60	0	0.600
January, 1854	.264	.232	.245	.247	13.74	22.52	13.95	16.52	61	—24	1.593
February, 1854	.192	.135	.151	.159	18.71	36.79	24.43	26.63	57	—6	3.410
March, 1854	.190	.141	.191	.174	30.65	46.52	31.36	36.18	71	12	3.420
April, 1854	.203	.150	161	.172	50.33	61.67	50.40	55.90	81	38	†0.400
May, 1854	.173	.111	.103	.129	51.73	67.34	55.82	58.30	89	32	†1.100
June, 1854	.170	.104	.097	.124	63.10	77.20	64.70	68.30	91	49	†0.450
July, 1854	.290	.229	.249	.256	69.80	82.70	68.40	73.60	100	49	‡ —
August, 1854	.260	.202	.198	.220	72.10	86.61	70.57	76.43	98	62	‖ —
Mean of all	27.227	27.180	27.192	27.200							

Means of temperature—spring, 49.89°; summer, 72.78°; autumn,§ 46.85°; winter, 25.38°; year, 48.72°.

Altitude of Fort Benton from these observations, 2662.9 feet.

* For the last seven days only.

† In part, several rains not measured.

‡ Two days on which rain fell.

‖ Four days on which rain fell.

§ Mean for September assumed at 68°. See remarks for notice of the peculiar temperatures of the seasons.

LETTER OF LIEUTENANT MULLAN, U. S. A., TO GOVERNOR I. I. STEVENS, TRANSMITTING METEOROLOGICAL REGISTER KEPT IN THE ST. MARY'S VALLEY.

OLYMPIA, W. T., *December* 17, 1854.

SIR: I have the honor herewith to transmit a Meteorological Register kept in the St. Mary's valley from the 8th of October, 1853, to 18th of September, 1854. I have, during the last year, submitted for your perusal monthly registers from time to time, which have been transcripts from this register. You will find the register full as to details, and which renders unnecessary my referring to it except in a general manner. It was found in the St. Mary's valley that snow did not fall during the last winter to a greater depth than from three to four inches, after several successive falls of snow. The winter, with the exception of a few days in December and January, was remarkably mild. During those days, however, the cold was intense. The thermometer in the St. Mary's valley ranged as low as twenty-eight degrees below zero. During my examinations through the mountains—and I was travelling every month except February—I did not find the snow at any point deeper than fifteen inches, and this was on the summits of the Snake river mountains on the south, in December and January, and the summits of the main divide of the Rocky range in March. Though, I must say, I crossed at the most favorable points of the two ranges, I am convinced that at other points the snow fell to much greater depths; but, of course, at points never travelled in the winter season.

The points I refer to are the passes which I deem practicable for travelling with horses at all seasons, even mid-winter.

If the results of last winter are taken as data, I consider the problem of the snows of the mountains solved. Still I deem it essentially necessary, in view of the great interests depending upon this important problem, that further and minute observations should be made at different points in the mountains. I might suggest, in addition to the St. Mary's valley, the Cœur d'Alene mission, the Upper Pend d'Oreille mission, the Spokane prairie, at the ranche of Messrs. Owen and Gibson, and also at Forts Benton and Wallah-Wallah. The latter is not essentially necessary, but would afford a great facility and means of comparison with points in the mountains. A thermometer, with a register, might be kept at Mr. Craig's, a man of sufficient intelligence, and who, I have no doubt, would feel an interest in the matter; together with the different Indian agencies that may hereafter be established throughout the territory east of the Cascade range of mountains. Having reported to you several times on the character of the winter and snows, I deem any further details unnecessary.

With respect, your obedient servant,

J. MULLAN,
Lieutenant U. S. Army.

Governor ISAAC I. STEVENS.

Observations made at Cantonment Stevens, St. Mary's Valley, Washington Territory, for the month of October, 1853, by F. H. Burr, of Lieut. Mullan's party.

Latitude 46° 20′ 10″; longitude 113° 55′; height of station above the sea 3412.5 feet.

Barometer (Green's Syphon) No. 769.

Date.	Barometer.			Attached thermometer.			Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.			Wind, direction and force.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
Oct. 9	96.230	—	96.430	45	—	59	96.191	—	96.352	—	42.5	—	49	—	4	—	5	0	—	0	Heavy frost; sun obscured at intervals; clouds dark and heavy.
10	—	—	.320	—	—	62	—	—	.241	—	—	—	58	—	—	—	0	—	—	0	Day warm; evening clear.
11	.284	96.398	.638	49	56	52	.235	96.333	.566	96.378	50	56	49	51.7	1	5	1	0	NW. 2	0	Clear sunrise; sun obscured at midday; cool and pleasant.
12	.620	.784	—	28	53	—	.619	.736	—	—	31	55	—	—	1	1	—	0	0	—	Cool morning; calm and warm.
13	.698	.644	.566	43	57	55	.664	.576	.503	.581	45	58	57	53.3	1	1	0	0	0	0	Mild morning; calm and warm, pleasant.
14	.562	—	.608	44	—	62	.525	—	.539	—	38	—	60	—	1	—	2	0	—	0	Cool, pleasant morning; clear and warm.
15	.568	.710	.680	50	64	52	.517	.595	.624	.579	48	69	58	58.3	4	1	1	0	N. 1	0	Clear and warm; evening cool.
16	.610	.508	.530	54	69	61	.550	.434	.453	.479	49	65	57	57.0	0	0	2	S. 1	SW. 1	SW. 1	Pleasant; cool breeze; warm.
17	.606	.600	.618	57	58	62	.538	.530	.539	.536	50	58	58	55.3	1	9	9	SW. 1	N. 2	0	Pleasant morning; slight shower of rain; warm; atmosphere hazy.
18	.622	—	.656	54	—	53	.562	—	.598	—	49	—	49	—	10	—	1	N. 1	—	0	Cloudy; evening clear.
19	.726	.758	.764	45	55	50	.687	.694	.612	.664	32	58	36	42.0	1	1	1	0	SW. 2	SW. 1	Heavy frost; clear and warm at midday; evening cool.
20	.730	.762	.758	40	48	52	.703	.715	.701	.706	33	43	32	36.0	8	9	3	0	NW. 2	NW. 1	Cloudy and cold.
21	.684	—	.676	30	—	28	.659	—	.653	—	26	—	16	—	1	—	1	0	—	0	Clear and cold day.
22	.640	.618	.618	23	45	45	.641	.579	.579	.600	20	41	29	30.0	1	5	10	0	S. 1	0	Morning cold; drizzling rain and sleet in p. m.
23	.636	.232	.256	40	45	50	.599	.193	.205	.332	30	45	36	37.0	10	10	10	0	SE. 1	0	Drizzling rain and sleet; ceased at 12 m.; snowing on mountains.
24	.344	—	.538	44	—	40	.307	—	.511	—	36	—	31	—	8	—	2	N. 1	—	0	Cloudy; slight fall of snow at 1 p. m.
25	.392	.360	.329	40	50	59	.365	.309	.256	.310	37	46	40	41.0	10	10	2	SE. 2	SE. 2	0	Gloomy and disagreeable, with squalls of snow at intervals all day.
26	.466	.620	.698	37	49	38	.446	.571	.675	.564	38	49	41	42.7	8	9	2	E. 1	NW. 2	SE. 1	Pleasant and mild; fair night, with heavy frost.
27	.822	.912	.840	37	45	42	.802	.873	.806	.827	35	46	44	41.7	2	3	3	SE. 2	S. 1	S. 3	Heavy frost; pleasant day.
28	.796	—	.798	41	—	53	.766	—	.740	—	42	—	53	—	8	—	4	SE. 2	—	0	Pleasant morning; evening quite warm.
29	.604	.524	.400	58	67	51	.534	.433	.347	.438	55	68	49	57.3	3	9	10	SW. 3	ESE. 4	ESE. 1	Morning clear; violent wind in night; warm, cloudy, squalls of rain and wind.
30	.466	.484	.479	38	46.5	31	.423	.441	.466	.443	41	47	32	40.0	6	6	8	W. 1	WSW. 3	N. 1	Squalls of wind and snow; snowing steadily after 8 p. m.
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No observations.
Means..	....	....	....	......	......	......	96.547	96.533	96.529	96.534	39.5	63.6	44.5	45.9	4.9	5.4	3.7	....	....	....	

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of November, 1853, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer.			Attached thermometer.			Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.			Wind, direction and force.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
Nov. 1	26.442	26.542	26.542	29	34	31	26.441	26.539	26.536	26.502	29	35	30	31.3	9	9	9	E. 1	ESE. 1	E. 2	Cloudy morning; occasional squalls of snow; cold, snow lies on the ground.
2	.576	.518	.510	28	36	19	.577	.500	.532	.536	20	36	19	25.0	9	1	1	9	0	0	Cool morning; warm; heavy frost.
3	.516	.630	.589	19	34	24	.538	.617	.593	.583	17	37	25	26.3	1	0	9	0	0	W. 1	Clear morning, frost heavy; mild, calm; cool pleasant evening.
4	.650	.712	.720	33	28	22	.639	.713	.736	.696	34	28	22	28.0	10	0	10	0	N. 2	0	Cool morning; squalls of snow after 7 a. m.
5	—	.544	.459	—	29.5	24.3	—	.542	.482	—	—	30	26	—	—	10	10	—	0	0	Mild, with occasional snow squalls.
6	.304	.265	.268	27	36.5	30	.298	.266	.264	.279	20.5	36	32	29.5	10	3	0	0	0	0	Cloudy, dull morning; mild, clear, and cool.
7	.368	.278	.492	28	36	25	.369	.260	.500	.343	30	35	28	31.0	0	10	0	0	WSW. 1	E. 1	Clear, cool; snowing hard; wind very variable after 2 p. m.
8	.744	.760	.716	31.5	47	44.5	.737	.716	.678	.710	31.5	47	26	34.8	0	0	0	WSW. 1	0	0	Beautiful morning; clear and calm.
9	.532	.496	.406	24.5	46.5	37	.540	.456	.388	.461	24.5	46.5	37.5	36.2	4	9	6	0	9	SW. 2	Beautifully clear and calm; clouded sky, though pleasant.
10	.172	.106	.136	40	42	36	.145	.075	.119	.113	40.5	42.5	37.5	40.2	0	2	6	SW. 2	SSE. 2	SSW. 4	Clear morning; drizzling after sunrise; windy, cloudy in NNE.
11	.200	.312	.326	34	34	30	.187	.299	.322	.269	34	33	30	32.3	10	3	4	E. 3	ESE 4	S. 1	Snow began at 5.30 a. m.; slight snow squalls after 9 a. m.
12	.292	.190	.292	34	38	37	.279	.168	.272	.239	33.5	37.5	39	36.7	10	5	6	SSW. 3	SW. 2	SW. 3	High wind last night; snowing after 6 a. m.; moderate rain; clear.
13	.218	.156	.196	37	37	35	.198	136	.181	.172	39	38	35	37.3	7	9	9	0	SW. 2	SW. 2	Clear, cool; squalls of rain till 12 m.; snowing, violent gusts.
14	.390	.440	.478	23	37	20	.403	.420	.498	.440	23.5	37	20	26.8	0	0	0	SE. 1	S. 1	0	Pleasant, cool; heavy frost.
15	.488	.442	.392	17	27	15	.515	.446	.424	.462	18	28	15	20.3	3	8	1	0	0	0	Heavy frost; sky covered with fleecy clouds.
16	—	.308	.352	—	32	23	—	.300	.348	—	—	32	21	—	—	10	2	—	0	9	Mild, appearance of snow storm; heavy frost.
17	.406	.392	.370	31	34	21	.400	.369	.364	.378	30	37	31	32.7	2	1	3	SE. 2	0	SW. 3	Cold, raw wind; mild, calm; wind at night.
18	.372	.380	.370	40	49	29	.345	.331	.345	.340	40	49	40	43.0	8	5	10	SE. 3	W. 1	SSW. 3	Begins snowing; ceased at 10 a. m.; pleasant; squalls of wind and snow.
19	.388	.430	.420	37	49	41	.368	.381	.390	.380	38	49	42	43.0	7	10	10	SSW. 1	SSW. 1	SW. 1	Slight showers during night; warm, mild; occasional showers of rain.
20	.424	.448	.480	42	49	45	.392	.397	.441	.410	42	49	44	45.0	10	10	8	SW. 1	SSW. 1	SSW. 1	High wind last night SSW.; rain steady at 2 a. m.; ceased at 11; showery.
21	.478	.492	.470	52	52	49	.422	.436	.421	.426	51	51	48	50.0	9	9	2	SE. 3	SSE. 3	SSE. 2	Day warm and windy; cool evening.
22	.445	.390	.450	52	50	37	.389	.318	.430	.379	49	57	37	47.7	4	8	10	SSE. 3	NW. 1	0	Violent wind last night; rain at intervals after 10 a. m.; rain at 7 p. m.
23	.506	.492	.432	34	35	30	.493	.477	.428	.466	33	32.5	30	31.8	10	9	10	0	ESE. 1	0	Snow began at 11 p. m.; ceased at 10 a. m., (four inches deep;) cool, damp.
24	.428	.450	.434	29	29	25	.427	.449	.442	.439	30	27	25	27.3	10	10	10	9	0	E. 1	Cool and damp, appearance of snow; calm.
25	.248	.174	.166	24	26.5	25	.259	.179	.174	.204	21	26	24	23.7	10	10	10	9	0	0	Cold and cloudy; clear from 8 to 11 a. m.; appearance of snow; cold and calm.
26	.098	.152	.150	31.5	41	37	.091	.133	.130	.118	28	41	36.5	35.2	4	10	6	0	ESE. 2	S. 2	Sun shining warmly; snow nearly melted; hazy, mild.
27	.150	.198	.164	38	38.5	31.5	.198	.105	.157	.130	37	39	31	35.7	9	7	10	0	9	E. 2	Mild; slight rain in night; clear from 8 to 1 p. m; violent squall of wind and snow from SW.
28	.408	.418	.248	31	33.5	33	.402	.406	.237	.348	31	33.5	33	32.5	8	10	10	SW. 2	S. 3	SW. 4	Cold wind, appearance of snow; clear from 10 to 12 m.; snowing.
29	.354	.424	.444	40.5	44	40	.396	.367	.417	.377	40	43	40	41.0	10	10	7	SW. 3	SW. 3	SW. 3	Violent rain during night till 8 a. m.; windy and disagreeable; violent wind at intervals.
30	.512	.656	....	44.5	48	—	.474	.610	—	—	44	47	—	—	8	8	—	WSW. 3	SSE. 2	—	Violent wind at intervals in night; warm and windy; squalls of rain.
Means	....	....	....	......	......	......	26.392	26.380	26.387	26.383	32.5	38.6	31.2	34.1	6.5	6.2	6.2	....	....	....	

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of December, 1853, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer.			Attached thermometer.			Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.			Wind, direction and force.			Daily remarks on the weather.
	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	Mean.	7 a. m.	2 p. m.	9 p. m.	Mean.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	
Dec. 1	26.642	26.656	26.590	49	57.5	38	26.593	26.587	26.567	26.582	48	55	35	46.0	3	2	0	SW. 1	W. 1	0	Violent wind last night; now pleasant; warm light clouds, clear night.
2	.624	.684	.627	40	50	40.5	.597	.573	.598	.589	41	48	40	43.0	10	10	6	0	0	SSW. 1	Warm, appearance of snow; slight shower at 1 p. m.; rain at 8 p. m., mild and damp.
3	.648	.658	.610	37.5	49	38	.626	.609	.622	.619	38	49	37	41.3	10	5	0	0	E. 2	W. 2	Damp and foggy, slight rain in night; slight showers through the day.
4	.560	.436	.400	28	40.5	33.5	.561	.408	.388	.452	28	39	33	33.3	2	5	7	0	0	W. 1	Heavy frost, pleasant, hazy sky; slight snow squall at 8½ p. m.
5	.604	.676	.694	43	49	43.5	.570	.627	.648	.615	42	48	43	44.3	4	10	7	0	SW. 3	0	Pleasant; squalls of wind from SW.; appearance of snow; mild.
6	.804	.876	.832	32	41	28	.796	.846	.833	.825	31.5	45	29	35.2	2	1	0	0	0	0	Heavy frost; pleasant, beautiful day; pleasant evening.
7	.812	.832	.786	23.5	40	25.5	.800	.805	.793	.799	24.5	39	25	29.5	0	3	0	0	E. 1	0	Heavy frost, pleasant; fleecy clouds in east; fine.
8	.820	—	.314	21.5	—	23	.637	—	.327	—	22	—	23.5	—	0	—	8	0	—	0	Heavy frost, thick mist; appearance of snow.
9	.130	.174	.186	25	38	32	.138	.151	.178	.156	21	37.5	31	29.8	10	9	5	SSW. 1	E. 2	E. 1	Slight rain; snowing on mountains, cold wind; slight squalls of snow at 7 p. m.
10	.250	.190	.184	23	32.5	30	.263	.180	.180	.208	23	32	30	28.3	2	10	10	0	0	0	Cold, pleasant morning; cloudy, appearance of snow.
11	.488	.540	.546	27.5	38	22	.490	.517	.562	.523	19	37	23	26.3	7	2	0	0	0	0	Heavy frost, clear and mild; night pleasant.
12	.460	.326	.288	24.5	39	23.5	.469	.301	.300	.357	25	42.5	24	30.5	3	6	2	0	W. 1	0	Heavy frost; fleecy clouds, warm; heavy frost.
13	.346	.380	.426	25	35	29	.354	.395	.425	.391	26	25	29.5	26.8	10	10	9	0	0	0	Light frost, appearance of snow; snowing from 10 a. m. to 1 p. m., ½ inch deep.
14	.540	.556	.576	31	37	30	.534	.536	.572	.547	30	35	30	31.7	6	2	10	0	0	W. 1	Mild; irregular clouds, pleasant; snow melting fast; cold and cloudy.
15	.606	.606	.588	33	32	22	.595	.598	.601	.599	31.5	31	23.5	28.7	10	10	6	0	0	NW. 1	Cold and cloudy; appearance of snow storm.
16	.558	.562	.594	22.5	32.5	28.5	.572	.553	.594	.573	23	32	29	28.0	10	10	9	SW. 1	0	NW. 1	Began snowing at 6 a. m.; squalls of snow at intervals; slight fall of snow; cold.
17	.564	.526	.650	40.5	38	25	.536	.563	.642	.580	40	36	25	33.7	7	3	0	WSW. 2	WSW. 2	0	Snow and sleet; squalls of wind; violent squall of wind from SSW. at 6 p. m.
18	.674	.686	.516	16	24	11	.704	.677	.558	.646	18	24	12	18.0	0	0	0	0	0	0	Heavy frost; pleasant; large halo around moon.
19	.410	.409	.188	16	26	19	.440	.415	.211	.355	17	26	19	20.7	10	9	10	0	NNE. 1	WNW. 1	Cold, threatening a snow storm.
20	.236	.212	.402	25	31	24	.244	.206	.413	.288	25	32	24	27.0	10	10	10	0	0	NNE. 1	Cold, threatening snow.
21	.260	.292	.374	31	25	15	.254	.300	.406	.320	30	24	15	23.0	10	9	3	NNE. 1	NW. 1	0	Snowing slowly until 2 p. m., 1-inch deep; clear; heavy frost.
22	.596	.520	.488	16	12.5	2	.570	.558	.551	.560	11	12	3	8.7	1	0	0	0	0	0	Heavy frost, snow crisp; bright star-light, cold.
23	.400	.498	.396	5	24	19	.456	.439	.451	.449	4	23	19	15.3	0	10	8	0	0	0	Clear morning; cloudy at 12 m.; heavy frost, calm.
24	.294	.310	.348	27	31	24	.290	.304	.329	.308	27	30.5	23.5	27.0	10	10	3	SW. 3	SW. 1	SW. 3	Cold wind during day; clear sunset.
25	.398	—	—	22	—	—	.414	—	—	—	22	—	—	—	5	—	—	SW. 1	—	—	Began snowing at 10 p. m; ceased at 1 a. m.; 1-inch deep.
26	—	.294	.294	—	40	34	—	.267	.281	.274	—	39	34	—	—	8	8	—	SSW. 3	SSW. 2	Strong SSW. wind for the last 40 hours.; mild; slight snow squall at 7 p. m.
27	.360	.402	.458	35	44.5	37	.345	.364	.438	.449	35	43	37.5	38.5	10	10	7	SSW. 2	SSW. 1	S. 2	Mild and damp, appearance of rain.
28	.258	—	.272	45	—	31	.219	—	.266	—	44	—	31	—	10	—	10	S. 1	—	SW. 1	Rain begins steadily, mild; snowing at 5 p. m.; wind shifted to NE., then to SW.
29	.408	—	.634	28	—	28	.409	—	.653	—	29	—	29	—	4	0	0	0	0	0	Clear and calm, snow 2 inches deep; wind NW. at sunset.
30	.790	.806	.792	30	35	26	.786	.791	.798	.792	31	34	26	30.3	10	8	0	SSE. 1	SE. 1	0	Appearance of snow; snow melts fast; clear night, calm.
31	.796	.834	—	27	37.5	—	.802	.812	—	—	28	36.5	—	—	1	1	—	0	N. 1	—	Clear, fine morning; snow melts fast.
Means.	....	....	....	......	......	......	26.502	26.496	26.490	26.496	28.1	35.4	27.0	30.2	5.9	6.2	4.8	....	....	....	

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of January, 1854, by F. H. Burr, of Lieutenant Mullan's party.

Date.	Barometer.			Attached thermometer.			Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.			Wind, direction and force.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	A. M.	2 P. M.	9 P. M.	
Jan. 1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No observations.
2	—	26.462	26.464	—	47	47	—	26.418	26.420	—	—	45	47	—	—	10	10	—	SSE. 5	NW. 6	Heavy wind all day; squalls of rain at intervals; snow squalls from NW.
3	26.158	.186	.268	35	40	28	26.143	.159	.249	26.184	24	41	27	31	9	8	10	NW. 2	SW. 5	SSW. 6	Snow and rain squalls; wind variable; clear sunset; snowing from SW.
4	.344	.610	.854	8	1.5	*	.393	.642	.956	.664	7	1.5	—11	— 0.8	2	9	0	NW. 2	NW. 5	0	Snow ½ inch deep; cold; snow drifting; intensely cold; clear.
5	.936	.908	.882	— 7	— 1.5	*	27.011	.979	.970	.983	— 9	— 2.5	—13	— 8.2	0	0	0	0	0	0	Pleasant; bright sunshine; clear and cold.
6	.892	.810	—	— 4	0	—	26.960	.884	—	—	— 5	— 1	—	—	9	10	—	N. 1	NE. 1	—	Pleasant; cloudy; light breeze.
7	—	.666	.690	—	17	32	—	.715	.692	—	—	15	31	—	—	10	10	—	0	SSE. 3	Cloudy; appearance of snow.
8	.526	.460	.440	36	33	26.5	.506	.449	.421	.459	31	33	36	33	9	10	9	SSE. 3	NW. 1	SW. 2	Cloudy, with stiff breeze; damp; clouds in masses.
9	.378	.342	.406	37	42	34	.358	.310	.393	.354	39	41	33	37.7	10	8	7	SSE. 2	SW. 3	0	Raw, damp wind; slight rain and sleet at 9 a. m.; rain and snow.
10	.636	—	—	30	—	—	.632	—	—	—	31	—	—	—	3	—	—	S. 1	—	—	Pleasant morning.
11	—	—	25.880	—	—	35	—	—	25.865	—	—	—	33	—	—	—	9	—	—	0	Snowing from 3 a. m. until 4 p. m.; rain and snow at sunset.
12	.168	.294	26.300	25	28.5	13.5	.176	.294	26.336	.269	24	26	14	21.3	2	10	3	0	SSW. 1	0	Snow 3 inches deep; cold and cloudy; cold and clear.
13	.162	.100	.134	0	6	0	.208	.154	.202	.188	10	7	0	5.7	10	10	10	NW. 1	N. 1	NW. 1	Snowing slowly until 7 a. m.; 2 inches deep; cold intense.
14	.124	.130	.132	— 5	2	— 9	.204	.183	.231	.206	— 4	1	—10	— 4.3	10	7	3	0	W. 1	0	Intensely cold; sunshine a few moments; cold.
15	.392	.398	.419	—10	— 1	— 9	.413	.398	.470	.427	— 9	— 1	—12	— 7.3	2	0	7	0	0	0	Clear, cold day; light fleecy clouds at evening.
16	.326	.288	.262	— 9	— 2	— 6	.394	.360	.342	.365	—14	— 4	— 6	— 8	0	8	9	0	0	0	Clear; cloudy and cold; appearance of snow; snowing.
17	.250	.250	.262	— 2.5	4	— 1.5	.322	.308	.353	.328	—12	2	— 6	— 5.3	10	10	9	0	0	0	Snowing very lightly most of the day; faint sunshine; snow ¼ inch deep.
18	.292	.188	.124	— 3.5	5	— 2	.338	.244	.197	.260	— 6	3.5	— 2	— 1.5	1	0	10	0	NNE. 1	0	Sky hazy; appearance of snow; began snowing slightly at 8 p. m.
19	.212	.182	.572	—10.5	5.5	*	.305	.237	.678	.407	—12	— 7	—29	—16	2	0	0	NW. 3	NW. 1	WNW. 1	Clear and intensely cold.
20	.660	.606	.440	*	1	1	.720	.671	.505	.632	—22	— 2.5	1	— 7.8	9	9	10	WNW. 1	N. 1	SSW. 3	Thermometer 28° below zero at daybreak; hazy after 8 a. m.; milder after 2 p. m., and snowing.
21	.274	.334	.630	12	17	— 2	.313	.361	.702	.459	11	14.5	— 3	7.5	0	8	0	SSE. 2	WSW. 1	WSW. 1	High S-E. wind last night; mild, hazy, and cloudy; clear.
22	.892	—	—	— 2	7	—	.964	—	—	—	— 9.5	5	—	—	0	0	—	0	0	—	Clear and mild all day.
23	—	—	.528	—	—	*	—	—	.622	—	—	—	—11	—	—	—	0	—	—	0	Clear, cold all day.
24	.270	.072	.054	5	7	7	.336	.123	.105	.185	— 9	5	5	3.3	10	10	10	0	0	0	Hazy; snowing after 8 a. m. slowly and steadily; 2 inches deep.
25	.308	.448	.500	10	21	24	.412	.466	.536	.471	8	19	22	16.3	2	0	10	WSW. 1	0	SSE. 2	Pleasant; cloudy; cloudy and windy.
26	.652	.720	.732	34	31	12	.639	.722	.771	.711	29	29	12	23.3	2	1	10	SSE. 2	0	0	Mild and pleasant; snow melts; cold and cloudy after 7 p. m.
27	.676	.636	.658	30	38	37	.680	.613	.638	.644	29	37	37	34.3	10	10	10	S. 2	S. 2	SSE. 1	Mild and cloudy; drizzling rain; snow melts fast.
28	.668	—	.656	33	—	33	.657	—	.647	—	32	—	32	—	9	—	10	0	—	0	Damp and mild; snow melts fast.
29	.682	.730	—	38	44	—	.659	.713	—	—	37	48	—	—	10	8	—	0	0	—	Light drizzling rain; very mild; snow melts; rain ceased at 10 a. m.
30	.718	—	.534	42	—	39	.686	—	.500	—	49	—	39.5	—	8	—	0	S. 5	—	SSW. 3	Windy last night; mild morning; warm at noon; clear and windy.
31	.560	.436	.344	45	54	38	.541	.366	.321	.409	46	52	36	44.7	5	8	10	SSW. 1	W. 1	W. 2	Mild; thawing; warm, with pleasant breeze; light rain at 8 p. m.
Means	....	....	....	......	......	......	26.496	26.449	26.466	26.471	12.1	10.0	11.8	13.3	4.9	6.4	6.0	....	....	....	

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of February, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer.			Attached thermometer.			Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.			Wind, direction and force.			Daily remarks on the weather.
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
Feb. 1	26.418	26.498	26.640	37	29.5	20	26.398	26.425	26.660	26.404	31	29	21	28.0	2	3	0	SW. 1	W. 2	0	Mild morning; pleasant; cold at night.
2	.691	.552	.492	17	32.5	27	.721	.549	.426	.563	17	32	28	25.7	0	0	0	0	NE. 1	0	Clear and fresh; milder; clear.
3	.396	—	—	13	34	40	.430	—	—	—	14	33	39	28.7	2	2	3	0	NNW. 1	ESE. 1	Pleasant; mild day; pleasant.
4	—	.566	.566	37.5	40	24.8	—	.639	.572	—	37	44	24	35.0	9	3	0	0	N. 1	0	Cloudy and damp; warmer; clear.
5	.616	.608	.508	21.5	35	24	.633	.593	.519	.582	22	34	25	27.0	0	0	0	0	E. 1	0	Heavy frost; warmer; frost at night.
6	.592	.532	.466	23	37	37.5	.545	.512	.447	.501	24	36	27	29.0	8	5	4	0	E. 1	SSE. 3	Heavy frost; cloudy; slight snow squall; clear
7	.510	.568	.600	35	40	36	.495	.541	.582	.539	34	38	35	35.7	10	5	5	SE. 1	S. 2	0	Slight fall of snow in night; mild and damp; hazy.
8	.548	—	—	39	—	—	.523	—	—	—	37	—	—	—	5	—	—	0	—	—	Mild and cloudy.
9	.364	.260	—	41	48	—	.334	.214	—	—	40.5	46	—	—	5	8	—	WSW. 2	SSE. 2	—	Mild and pleasant, with high winds.
10	.192	.460	25.902	33.5	45	33	.110	.422	25.891	.141	33.5	42	34	36.5	5	5	9	SW. 1	SW. 1	0	Cloudy; mild, with fresh winds.
11	25.838	.032	26.070	34	34.5	28	25.823	.016	26.071	25.971	35	35.5	28	32.8	6	7	4	WNW. 2	ESE. 1	WSW. 2	Slight snow in night; occasional squalls through the day.
12	.164	.114	.070	28.5	35	29	.164	.099	.069	26.111	27.5	35	29	30.5	0	2	8	WSW. 3	S. 2	S. 1	Cool and pleasant; cloudy at evening
13	.118	.214	.342	28	32	23.5	.119	.206	.351	.226	27	31	23	27.0	5	3	5	S. 1	WNW. 2	0	Snow in night; cold and cloudy; snow squalls through the day.
14	.539	.562	.546	28	30	23	.533	.558	.533	.541	27	27.7	23	25.9	5	4	10	0	0	0	Snow an inch deep; hazy, with appearance of snow.
15	.462	.464	.414	21	31.5	24	.480	.457	.425	.454	21	29.7	24.5	25.1	10	10	10	0	0	0	Snow from 5 a. m. to 4.30 p. m.—1½ inch.
16	.484	.524	.522	23.7	37.5	21	.496	.503	.533	.511	24.5	34.5	23	27.3	6	4	0	0	N. 1	0	Cloudy and pleasant; warmer; snow melts; clear.
17	.578	.566	.530	19	38	27	.601	.543	.534	.559	17	36.5	27	26.8	0	5	9	0	0	0	Heavy frost; snow melts; mild and hazy.
18	.528	.468	.434	29	41	25	.527	.438	.442	.469	29	39	25	31.0	7	0	0	0	0	0	Heavy frost; pleasant and warm.
19	.466	.472	.440	21.5	38.5	27	.483	.448	.444	.456	22	38.5	26.5	29.0	3	2	1	0	0	0	Frost; pleasant; clear.
20	.440	.448	.468	27	39.5	32.5	.444	.420	.459	.441	27	38	32	32.3	5	5	8	0	0	0	Cloudy; pleasant; snow squalls after 4 p. m.
21	.530	.628	.644	30.5	42	24	.515	.596	.655	.589	30.5	40	24	31.5	6	2	0	0	E. 1	0	Cloudy morning; clear.
22	.634	.512	.496	25.5	46	36	.627	.470	.478	.525	26	44.5	36	35.5	5	2	2	0	S. 3	S. 3	Heavy frost; high wind all day.
23	.449	.486	.536	32	45	34	.440	.447	.513	.467	32	43.5	32.5	36.0	10	3	2	0	S. 1	0	High S. winds in night; damp; cloudy; mild.
24	.576	.646	.590	32.8	43	25	.565	.612	.598	.592	31.5	41	24.5	32.3	3	5	0	WSW. 1	W. 1	0	Cloudy; clearing; pleasant; frost at night.
25	.518	.338	.284	23.5	43	32	.530	.304	.276	.370	24	41.5	31.5	32.3	3	7	10	0	0	0	Heavy frost; warm; appearance of rain.
26	.312	.372	.330	29	31.5	28	.311	.355	.331	.332	29	39.5	28	32.2	7	5	0	0	WSW. 1	SW. 2	Cloudy, mild and damp; flurries of snow in p. m.
27	.292	.312	.288	32	44	33	.264	.275	.277	.279	32	42.5	33.5	35.7	4	7	10	SW. 3	SW. 4	0	Raw, chilly, and violent winds; wind ceased, and snowing at evening.
28	.308	.214	.258	31	39	31.5	.292	.189	.251	.214	31	37	31	33.0	10	10	10	0	0	0	Snowing in large flakes to 3 p. m.—2 inches deep; snow squall at 7 p. m.
Means.	....	....	....	......	......	......	26.427	26.416	26.414	26.419	28.1	37.4	28.2	31.2	5.0	4.2	4.2	....	....	....	

NOTE.—The upper and lower clouds, as recorded in this month, do not appear to be sufficiently distinguished; or if so, not to differ in their direction.

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of March, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer corrected.					Open air thermometer.					Cloudiness, in tenths.					Wind, direction and force.					Daily remarks on the weather.
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	
Mar. 1	26.404	26.447	26.470	26.501	26.506	28	35	35	27	22.5	0	6	2	0	0	0	0	W. 1	W. 1	0	Cl'dy, with appearance of snow; pleas't; cl'r.
2	.522	.511	.500	.501	.501	22.5	26.5	36	29.5	27	10	10	7	1	0	0	0	0	0	0	Cloudy, threatening snow; clear.
3	.511	541	.401	.392	.370	28.5	30	36.5	32	31.5	3	1	5	0	0	0	0	S. 1	SSW. 2	SSW. 1	Clear & warm; cloudy, raw winds; cloudy.
4	.358	.346	.321	.326	.314	30	34.5	37.5	29	25.5	9	10	4	0	2	0	NE. 1	S. 1	0	0	Slight snow last night; cloudy; clearing.
5	.304	.405	.397	.420	.476	30	36	39	29.5	27	0	8	8	3	8	SW. 1	0	0	0	0	Heavy frost; fleecy clouds; clear.
6	.515	.542	.523	.503	.497	29	35.5	41	29	29.5	10	9	8	4	5	0	0	0	0	0	Heavy frost, clear; lowering masses of cl'ds; snow squall at 3 p. m.; clear.
7	.488	.410	.263	.151	.113	30	39.5	40.5	37	36	6	5	9	5	10	SSW. 3	SSW. 3	N. 1	S. 1	S. 2	Cl'dy, snow'g on distant mts.; sudden change of wind to S., with snow at and after 9 p. m.
8	.209	.267	.260	.229	.339	44	37.5	39.5	31	29	4	10	4	10	5	N. 2	W. 1	W. 2	0	S. 2	Snow 1½ inch deep; squalls of snow through the day; snow melting.
9	.381	.470	.459	.416	.352	30	38	44	41.5	37	3	4	10	10	4	0	S. 4	S. 3	SW. 2	SSW. 4	Clear and mild; mild winds; clear.
10	.096	.122	.222	.273	.297	42.5	34.5	33	28.5	26	9	10	10	2	3	SSW. 3	W. 3	W. 1	0	N. 1	Heavy wind in the night; rain at 8 to 9 a. m., then snow and rain alternately.
11	.311	.309	.290	.306	.329	37.5	32	35	25	24	3	1	4	3	0	WS. 1	WS. 1	W. 1	0	0	Clear and pleasant throughout.
12	.303	.247	.136	.146	.164	37	37	37.5	32	32	0	0	0	0	6	S. 3	S. 2	S. 2	S. 1	WS. 2	Clear & pleasant; cloudy, threatening snow.
13	.205	.233	.215	.234	.260	23	38	42.5	29	28	5	8	4	1	0	SSW. 3	SSW. 2	SSW. 1	0	0	High winds in night; mild and pleasant.
14	.278	.284	.257	.260	.303	34	39.5	44	38.5	37	9	10	5	5	5	SSW. 1	SSW. 1	S. 4	W. 1	W. 1	Cl'dy, with appearance of snow; high winds and squall at sunset.
15	.317	.384	.388	.413	.426	30	43.5	47	33	32.5	10	3	1	0	1	S. 2	S. 1	W. 2	0	0	Snow & heavy wind in night; pleasant day.
16	.418	.422	.422	.381	.509	45	48	56	40	36	0	1	0	0	0	S. 1	S. 1	SW. 1	W. 1	0	Clear and warm.
17	.519	.413	.481	.418	.432	40	51	55	42.5	37	1	1	1	0	0	S. 1	S. 1	0	0	0	Clear and warm.
18	.467	.458	.432	.471	.443	43	51	58.5	33.5	33.5	0	1	1	0	0	SSE. 1	0	N. 1	0	0	Clear and warm.
19	.458	.450	.344	.378	.300	43	48	57	42.5	37.5	1	1	3	2	1	0	0	0	0	S. 1	Calm, clear, and warm.
20	.305	.295	.292	312	.342	39	52	56	48	46	8	9	8	8	4	0	0	SW. 2	0	0	Cloudy; mountains covered with mist; clear at evening.
21	.522	.529	.541	.557	.616	50	55	56	41.5	34	9	7	4	0	0	SSE. 2	W. 1	N. 1	S. 1	0	Clear and warm.
22	.658	.677	.641	.515	.534	36	45	58	43	38.5	0	0	0	0	1	N. 1	0	S. 1	0	0	Pleasant and warm.
23	.637	.635	.581	.563	.565	50	54	60.5	41	34	4	4	1	0	0	S. 1	S. 1	0	0	0	Heavy frost; pleasant and mild.
24	.556	.541	.536	.396	.404	44.5	52	61	43	37	0	0	0	1	0	SE. 1	0	N. 1	0	0	Clear and pleasant.
25	.417	.421	.341	.349	.360	31.5	39	59	50	48	3	4	5	9	9	0	0	0	W. 1	S. 3	Heavy frost; warm & cl'dy, threatening rain.
26	.365	.302	.309	.295	—	42	46	50	56	—	6	4	4	9	—	0	0	SW. 4	0	—	Rain in the night; cloudy and mild.
27	.337	.336	.353	.371	.395	48	45.5	48	42	40	4	3	10	10	5	NW. 1	0	N. 1	SW. 2	0	Cloudy; appearance of rain, drizzling rain after 3 p. m.
28	.423	.417	.394	.397	.491	42.5	45.5	54	42	42	10	4	6	9	10	0	NW. 1	W. 2	W. 1	0	Rain during night and morning; showers alternately through the day.
29	.393	.375	.386	.343	.457	40	46	42.5	34	34	10	9	10	10	10	0	SW. 4	SW. 2	SW. 1	0	Rain through night and morning; squall of rain; snow squalls at and after 3 p. m.
30	.386	.411	.425	—	.567	35	39	37	—	29	4	4	10	—	0	0	SW. 3	W. 4	—	0	Snow during night; occasional snow squalls through the day.
31	.669	.696	.679	.617	.691	30	34.5	42	32.5	32	5	5	5	4	6	ESE. 1	SE. 1	WSW. 1	WSW. 1	0	Cloudy and misty, threatening snow; pleasant; cloudy.
Means..	26.412	26.418	26.396	26.383	26.408	37.8	41.0	46.8	36.7	33.4	4.7	5.0	4.8	3.7	3.4	....	....	....	....	....	

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of April, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer corrected.					Open air thermometer.					Cloudiness, in tenths.					Wind, direction and force.					Daily remarks on the weather.
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	
April 1	26.712	26.691	26.644	26.519	26.634	31	35.5	40.5	42	42	5	5	5	5	10	0	S. 1	S. 2	S. 3	S. 4	Cool and squally weather; slight rain.
2	.417	—	.421	.468	.447	48	—	47	44.5	43.5	6	—	10	5	5	SE. 3	—	0	S. 5	0	Moderate rain through a. m., and again at evening.
3	.611	.670	.674	.654	—	43.5	49.5	61	52	—	3	3	1	0	—	SW. 1	SE. 3	SE. 3	0	—	Cloudy until 12 m., then mild and pleasant.
4	.641	.645	.530	.488	—	62	58.5	63.5	57.5	—	0	5	3	2	—	S. 4	S. 3	SSE. 5	SSE. 3	—	Heavy wind through the day; slight rain at evening.
5	.691	.686	.666	.689	.567	56.5	54	56.5	45	41.5	2	0	5	0	0	S. 2	SSW. 2	S. 2	N. 1	0	Clear, pleasant day.
6	.601	.569	.504	.491	.618	60	60	53.5	40	42	0	2	3	5	4	SSW. 1	NNE. 1	NE. 1	0	NE. 1	Clear, pleasant day.
7	.607	.673	.597	.534	.579	39	47.5	50.5	44	35	4	5	0	0	0	NE. 1	NE. 1	NE. 1	N. 05	S. 05	Snow squall at 9 a. m; afterward clear.
8	.666	.632	.560	.504	.585	44	47	54	41.5	36	0	0	0	0	0	NE. 05	0	0	0	0	Day clear and pleasant.
9	.475	.421	.267	.190	.185	44	55	60	50	38	0	0	0	1	1	0	0	S. 1	0	0	Clear and pleasant.
10	.301	.296	.243	.248	.258	39	56	59	52	49	6	2	6	5	4	0	SE. 1	N. 1	S. 5	0	Cloudy; pleasant in p. m.
11	.269	.277	.269	.295	.367	40	49.5	50.5	45	43	5	5	4	5	5	NNW. 2	NW. 2	NW. 2	NW. 2	W. 4	Cool and cloudy day and night.
12	.560	.629	.564	.506	.613	38	49.5	53	43	34	5	0	0	1	0	W. 1	W. 1	WNW. 1	0	0	Morning cloudy; p. m. clear.
13	.686	.701	.696	.705	.727	42	50.5	55	50	46	4	3	6	6	5	S. 1	S. 2	NW. 2	0	0	Cloudy, pleasant.
14	.751	.729	.690	.651	.655	45	61	64	57	49	0	2	1	0	0	0	0	S. 1	0	0	Clear and fine day.
15	659	.549	—	.218	.221	59	69	—	54	53	0	0	—	1	2	SW. 1	—	—	0	SW. 1	Clear and fine day; post removed to "Horse Guard Camp."
16	.269	.259	.144	.134	.140	51	54	67.5	54.5	55	4	4	3	5	6	SW. 1	SW. 1	NW. 1	0	0	Heavy squalls of wind at 4 p. m.; thunder shower in the north.
17	.160	.163	.091	.105	.093	55	66.5	74	54	51	2	2	3	1	0	0	0	S. 1	0	0	Mild and pleasant day.
18	.103	.080	25.943	25.900	25.966	48	48	74	57	54	3	1	8	6	10	0	0	SW. 2	0	0	Mild; hazy, with appearance of rain.
19	.047	.037	26.083	26.053	26.016	46.5	57	57	49	47	5	2	3	5	2	W. 2	SW. 2	SW. 3	W. 2	W. 2	Cool; showers in afternoon.
20	.041	.010	25.874	25.933	25.951	41.5	50	59.5	46	43.5	6	8	8	3	2	S. 1	W. 1	WSW. 2	WSW. 1	0	Pleasant; distant thunder showers.
21	.004	—	26.017	26.105	26.136	39	—	48.5	39	39	10	—	8	10	10	0	—	NW. 2	WNW. 2	WNW. 1	Heavy fog; slight rain, and raw chilly winds.
22	.294	.314	.319	.340	.352	34.5	38	46	42	42	4	4	4	10	10	0	0	NW. 1	NW. 1	0	Slight snow in night; cloudy and pleasant.
23	.366	.365	.281	.242	.250	41.5	43	55.5	47	43	4	4	5	5	2	0	W. 1	WNW. 2	SW. 1	0	Cloudy, but pleasant.
24	.203	.149	.108	.061	25.975	41	45.5	56.5	56	48	9	0	10	2	3	0	0	W. 1	0	0	Cloudy; threatening rain in p. m.
25	25.994	25.966	25.963	25.969	.953	43	58	65	54	49	3	5	10	10	10	0	0	SW. 1	N. 2	SW. 1	Morning clear; slight rain at 4.30 p. m.
26	26.344	26.398	26.362	26.443	26.482	42	43	53	44	38	10	10	5	10	4	S. 1	0	W. 1	0	0	Cool and cloudy.
27	.530	.486	.444	.414	.431	45.5	65	56.5	45	42	2	0	2	0	0	0	W. 1	0	0	0	Heavy frost; day clear.
28	.419	.408	—	.275	.213	45	50	—	59	61	0	0	—	2	2	0	0	—	ESE. 2	NNE. 3	Heavy frost; day clear; violent wind at 9 p. m.
29	.197	.198	.014	.061	.226	51	55	74	60	59	7	3	4	10	5	0	0	0	NW. 1	NW. 1	Cloudy and mild.
30	.165	.138	.141	.163	.190	57.5	64.5	67.5	59.5	56	3	3	4	4	3	E. 2	E. 5	E. 1	N. 2	N. 2	Day warm and pleasant.
Means	26.578	26.567	26.530	26.504	26.511	46.1	53.2	54.9	47.4	41.5	—	—	—	—	—	....	....	....	....	....	
	26.204	26.214	26.195	26.182	26.163	45.5	59.7	60.8	51.8	48.8	—	—	—	—	—	....	....	....	....	....	

NOTE.—The first mean results embrace the observations to 9 a. m. of 15th; the second summary is for the remaining portion of the month at "Horse Guard Camp."
Monthly mean of temperature 48°.3; monthly mean of barometer 26.542 inches.

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of May, 1854, *by F. H. Burr, of Lieut. Mullan's party.*

Date.	Barometer corrected.					Open air thermometer.					Cloudiness, in tenths.					Wind, direction and force.					Daily remarks on the weather.
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	
May 1	26.275	—	—	26.377	26.375	51	—	—	68	61	2	—	—	3	1	0	—	—	0	W. 1	Frost; warm and pleasant, (at "Horse Guard Camp.")
2	.372	26.377	26.427	.431	.484	53.5	63.5	55	56	47	4	6	10	5	9	0	0	0	NW. 1	W. 1	Cloudy; hazy; rain at 1 p. m., with thunder, to 3 p. m.; clear evening.
3	.518	.518	.442	.443	.467	60.5	68	69	55	47	2	2	2	0	2	S. 2	S. 1	0	W. 1	0	Clear and warm.
4	.423	.309	.241	.126	.195	63.5	69	79	72	63	2	2	4	5	5	0	0	0	0	NW. 2	Slight haze; clear and warm.
5	.304	.306	.251	—	.249	47.5	54.5	61	—	51	10	6	4	—	10	0	NW. 1	NNW. 1	—	0	Cloudy; pleasant; cloudy.
6	.142	.131	.090	.098	.099	40.5	42.5	47.5	44.5	44	10	10	10	10	10	NNW. 1	NNW. 1	NNW. 1	0	0	Rain at intervals in night, and rain throughout the day.
7	.130	.136	.216	.318	.316	36	38	37.5	36	36	10	10	10	10	10	0	0	ESE. 1	0	0	Rain continued; flakes of snow; rain again at 7 p. m., with snow during the night.
8	.386	.402	.456	.437	.533	38	42	45	41	38	10	10	10	10	10	0	0	N. 2	0	0	Rain most of the day.
9	.555	.544	.507	.467	.496	37.5	51	56	47	42	10	10	5	5	5	0	0	0	0	0	Clouds breaking; pleasant; clear.
10	.494	—	.367	.316	.378	42	—	58	53	41.5	9	—	4	6	5	0	—	0	0	NNW. 1	Pleasant; p. m., cloudy and cool.
11	.358	.306	.234	.219	.229	48	55	60.5	50	42	4	5	4	4	4	0	0	S. 2	0	0	Warm and pleasant.
12	.280	.256	.250	.259	.280	54	56	56.5	53.5	42	0	5	5	2	3	0	0	NNW. 2	0	0	Clear morning; cloudy; pleasant.
13	.324	.304	.187	.240	.247	46.5	55	62.5	49	46	5	5	5	2	3	0	0	E. 1	0	0	Pleasant; thunder shower at 2 p. m. from E.; heavy rain 3 to 7½ p. m., with SE. winds.
14	.306	.314	.298	.323	—	54	57	62	55.5	—	10	10	4	4	—	NW. 2	NW. 2	N. 2	N. 2	—	Cloudy; threatening rain; clear.
15	.482	.490	.460	.526	—	68	61	76	47.5	—	0	2	0	0	—	0	N. 2	0	0	—	Clear and warm.
16	.629	.621	.600	.536	.584	49	67	61	59	49.5	9	3	6	2	0	SSW. 1	SSW. 1	NNE. 2	0	0	Cloudy and cool; clear; heavy shower at 10 p. m. for 30 minutes.
17	.602	.626	.455	.491	.580	53	63	71	65	51.5	0	0	1	0	0	0	0	W. 1	0	0	Clear and pleasant.
18	.634	.609	.521	383	.508	61	63.5	76	67	56	0	0	2	1	0	S. 1	S. 2	0	0	S. 1	Clear and warm.
19	.573	.653	.481	.470	.482	61	72.5	76.5	68	56	0	2	2	1	0	S. 2	E. 1	0	0	0	Clear and warm.
20	.632	.550	—	.417	—	66	73	—	67	—	0	1	—	0	—	0	0	—	0	—	Clear and warm.
21	.458	.450	.419	.380	.410	63.5	66.5	80	68	58	0	0	1	1	0	S. 2	0	S. 2	0	0	Very windy in morning; clear and pleasant.
22	.499	.509	.430	.405	.442	62	64.5	70	69	56	5	4	2	1	0	0	S. 1	SSW. 2	0	0	Clouds; clearing pleasant.
23	.502	.524	.495	.445	.458	66	76	78.5	69	58	2	1	1	0	0	SW. 2	SSE. 2	SW. 2	0	0	Clear and warm.
24	.404	.357	.274	.195	.337	60.5	74	76	67	64.5	0	0	5	5	10	S. 1	0	0	0	WNW. 2	Clear; p. m., cloudy, with appearance of rain.
25	.505	.514	.411	.308	.392	61.5	64.5	69	66	56.5	3	2	2	0	0	0	W. 1	NW. 1	WNW. 1	0	Clear and pleasant.
26	.386	.378	.268	.270	.250	60	66.5	61	62.5	62.5	0	0	0	0	0	W. 1	0	0	0	0	Clear and pleasant; *eclipse of the sun.*
27	.245	.213	.165	.370	.448	62	69	65	46.5	44	1	2	3	6	10	0	NW. 1	WSW. 4	WSW. 3	0	Morning clear; p. m., cloudy, with appearance of rain; slight rain at 8.30 p. m.
28	.459	.470	.439	.413	.429	38.5	40	49.5	47	44	10	10	10	4	10	0	0	NW. 2	0	0	Snow in night, 1½ inches; cold and cloudy; clouds breaking; rain at 9 p. m.
29	.462	.420	.449	.445	.449	48	49.5	46	41.5	40	4	10	10	10	10	SE. 2	0	S. 1	0	0	Cloudy and cool; rain at and after 5 p. m.
30	.362	.347	.331	.329	.316	40.5	42	43.5	44	43	10	10	10	10	10	0	SE. 1	S. 2	0	0	Rain until 4 p. m.; darkly cloudy.
31	.381	.401	.400	.408	.434	47.5	51	60	55.5	48	10	10	5	4	6	SSE. 3	SSE. 3	SSE. 2	0	0	Cool and cloudy; clearing; pleasant evening.
Means..	26.430	26.418	26.364	26.365	26.380	53.2	59.8	62.7	56.3	49.3	......	......	......	......	......	....	....	....	....	....	

Monthly mean of barometer, 26.393 inches; monthly mean of temperature, 56°.26.

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Observations made at Cantonment Stevens, St. Mary's Valley, for the month of June, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer corrected.					Open air thermometer.					Cloudiness, in tenths.					Wind, direction and force.					Daily remarks on the weather.
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	
June 1	26.447	26.433	26.320	—	26.376	57	61.5	67.5	—	53	6	2	4	—	8	0	0	NNW. 4	—	0	Clear; thunder storm in the east at 2 p. m.; slight shower at evening.
2	.367	.369	.356	26.408	.465	57	68	59	55	49.5	3	2	5	5	3	NNW. 1	0	N. 2	NNW. 2	0	Slight showers; heavy thunder showers in p. m.; cool and cloudy.
3	.497	.424	.490	.411	.437	55	68	64.5	63	51	10	10	4	2	4	NE. 2	NNW. 2	WSW. 2	0	0	Cloudy; pleasant; fair.
4	.475	—	.465	.461	.502	69.5	—	72.5	66.5	51.5	2	—	4	1	0	S. 2	—	SSW. 2	0	0	Warm and pleasant.
5	570	.513	.425	.392	.419	65	71	70.5	69	56.5	0	2	2	3	2	SSW. 1	N. 2	NW. 1	NW. 2	W. 1	Clear and warm.
6	.456	.449	.369	.394	.303	67.5	69.5	80	69.5	65	0	0	2	10	10	NW. 1	0	NW. 2	NNE. 2	0	Clear; cloudy; rain at evening and during night.
7	.335	.350	.385	.413	.438	55.5	65	61	55.5	55	5	3	10	10	10	0	NW. 1	NW. 3	0	0	Clearing; heavy thunder storm from NE. at 11 a. m.; rain at 1 p. m.
8	.500	.565	.467	.444	.519	55	65	68.5	66.5	57.5	6	4	3	3	4	0	NNW. 2	NNW. 2	W. 2	0	Cloudy and damp; clearing pleasant.
9	.591	.569	.506	.487	.529	69	68	70.5	68	56	2	1	2	2	0	0	N. 1	NW. 2	NW. 2	0	Clear and warm.
10	.589	.584	.490	.473	.580	70	71	75	70	63	1	4	3	4	4	0	0	NNW. 2	0	SSE. 1	Clear and warm; cloudy evening.
11	.511	.504	.411	.451	.463	65.5	66	74	60.5	56	4	4	4	3	2	SW. 1	0	0	0	0	Rain at 9 a. m., and showers afterward; pleasant.
12	.399	.385	.368	.313	.322	61	66	64.5	60	57	4	4	10	4	4	0	NW. 1	SW. 1	0	0	Pleasant; heavy showers after 11 a. m.
13	.317	—	.245	.557	.395	60	—	70.5	63	58.5	4	10	3	4	10	SW.	—	0	NNW. 1	0	Pleasant; distant showers in east; cloudy.
14	377	.389	.342	.370	.272	60	61	71	64	59	10	10	4	4	2	SW. 1	0	0	0	0	Cloudy; sultry; cooler at evening.
15	.258	.377	.176	.358	.354	69	70	66.5	58	55	2	2	4	5	2	0	0	SW. 3	NW. 2	NW. 2	Clear and warm; heavy showers westward.
16	.431	.440	.445	.420	.442	60.5	62.5	63.5	60	52	5	4	4	3	2	NW. 2	SSW. 2	W 3	0	0	Fair, cool and pleasant.
17	.447	.424	.354	.346	.345	60	67.5	73	61.5	54	3	2	10	10	10	0	NNE. 1	0	0	0	Fair; cloudy; showers after 6.30 p. m.
18	.390	.385	.324	.281	.345	64.5	63	69	63	55	4	4	3	2	6	SSE. 2	NNE. 1	NNW. 1	0	0	Clear and warm; cloudy evening.
19	.404	.405	.412	.439	.491	52	60	61.5	62	46.5	10	2	6	1	2	SW. 2	SW. 3	NNW. 2	0	0	Cool and cloudy; pleasant.
20	.497	.496	.356	.335	.361	65	65	81	68	62.5	2	1	4	4	10	0	0	SSE. 2	0	NE. 2	Clear and pleasant; cloudy and warm.
21	.387	.290	.200	.096	.080	59.5	66	86	72	69	2	4	4	10	10	SW. 1	0	0	0	WSW. 3	Clear and warm; sultry; heavy thunder showers at 2 p. m., and in night.
22	.494	.460	.424	.413	.452	67.5	71	76	66.5	59.5	4	4	2	2	0	W. 1	NW. 1	0	NW. 1	NW. 1	Clear and warm; fleecy clouds.
23	.389	.533	.380	.406	.461	57	70	81	69	61	4	1	1	0	0	0	0	NW. 2	NW. 2	0	Cool and pleasant; fleecy clouds.
24	.385	.363	.316	369	.310	76	75.5	73.5	61.5	59.5	0	10	10	10	10	0	0	SSE. 1	0	SW. 1	Clear and warm; cloudy; rain from 2 p. m. to 7.30 p. m.
25	.330	.341	—	.321	—	70.5	71	—	63	—	2	2	—	5	—	W. 2	0	—	SW 3	—	Pleasant; light clouds.
26	.379	.388	.379	.383	.509	55	57.5	61	58.5	50	5	3	4	3	2	SW. 2	S. 1	SW. 1	NW. 1	0	Raining in west; clear and pleasant.
27	.633	.643	.552	.485	.528	62.5	70	70	67	49.5	0	0	1	0	0	0	S. 1	0	NNW. 1	0	Clear and warm.
28	.565	.566	.463	.416	—	60	76	82	66.5	—	0	0	0	0	—	SE. 2	0	S. 5	0	—	Clear; high winds at times.
29	.327	.345	.143	.341	—	64	79	84.5	65.5	—	0	0	0	8	—	0	SSW. 2	SSW. 2	SW. 3	—	Pleasant; cloudy and cool; threatening rain.
30	.368	.365	.377	.303	—	61	61	65.5	56	—	5	3	3	2	—	SSE. 2	S. 2	SW. 3	W. 1	—	Slight rain in night; cloudy and windy.
Means..	26.429	26.433	26.368	26.384	26.406	62.7	67.1	71.5	63.7	56.3	......	......	......	......	......	....	....	....	....	....	

Monthly mean temperature, 64°.2; monthly mean of barometer, 26.401 inches.

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of July, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.		Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.				Wind, direction and force.				Daily remarks on the weather.
		7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	
July	1	26.411	26.411	26.366	26.360	66	65.5	67	59	0	0	0	0	WSW. 1	0	0	W. 1	Clear and pleasant.
	2	.434	.423	.386	.430	59.5	67	72.5	65.5	0	1	2	2	SW. 1	SW. 1	0	0	Cool; shower at 6 a. m.; fleecy clouds; pleasant.
	3	.556	.541	.464	—	69.5	77.5	79	—	1	1	1	—	SSW.	SW. 1	SW. 1	—	Fleecy clouds; pleasant; warm and sultry.
	4	—	—	.434	.440	—	—	76.5	68	—	—	0	0	—	—	0	0	Clear and warm.
	5	.468	.416	.312	.267	60	76	81	62.5	0	0	0	0	0	0	SW. 2	SW. 1	Clear and warm.
	6	.347	.414	.483	.457	58	49	65.5	57.5	5	10	3	3	WNW. 4	WNW. 4	SW. 3	SSW. 2	Cloudy and cool; slight fall of snow at 10 a. m. for 15 minutes; cloudy.
	7	.756	.756	742	.731	59	60.5	65.5	56	2	2	4	0	SW. 1	SW. 1	WNW. 1	0	Pleasant; clear and warm.
	8	.627	.609	.719	.674	65	71	75.5	66	0	0	0	0	SSE. 1	0	0	0	Clear, and pleasant.
	9	.753	.746	.672	.635	66	76.5	86	79	0	0	0	0	0	0	0	0	Clear; very warm.
	10	.692	.691	.616	.592	73.5	77.5	92.5	75	0	0	0	0	0	0	S. 1	0	Clear; scattered clouds; warm.
	11	.764	.654	.552	.490	76.5	86.5	94.5	83	0	0	1	0	0	0	W. 1	0	Clear and warm; scattered clouds.
	12	.690	.608	.507	.520	73.5	82.5	90.5	77	0	0	0	2	0	0	0	SW. 1	Pleasant; warm and sultry.
	13	.610	.608	.488	.495	64.5	81	86	77	0	0	0	0	0	0	0	SW. 1	Pleasant; very warm.
	14	.458	.435	.396	.398	71.5	79	84	74	0	0	1	0	0	0	SW. 1	0	Pleasant; scattered clouds.
	15	.438	.432	.342	—	80	80	81.5	—	0	0	0	—	S. ½	0	0	—	Clear and warm.
	16	.377	.494	.471	.496	55	59	70	58	0	3	1	4	E. 1	0	SW. ½	WSW. 2	Cool, cloudy morning; dark masses of clouds; cool wind.
	17	.585	.568	.500	.589	61.5	66	72	63	0	0	2	0	0	N.	0	SW.	Cool night; warm and clear.
	18	.607	.603	.495	.534	64	69.5	72.5	66	0	0	2	2	0	0	0	0	Pleasant; nearly clear.
	19	.507	.413	.439	.537	60	62.5	69	64	10	10	10	4	W. 1	SW. 2	0	SSW. 1	Cloudy and cool; heavy rain at 3 to 5 p. m.
	20	.592	.603	.513	.635	53.5	68.5	77.5	55.5	2	2	5	2	0	0	0	0	Clear; cloudy and raining on mountains west in p. m.
	21	.635	.537	.515	.434	55.5	66.5	79.5	85	2	0	2	5	0	0	0	0	Clear and warm; cloudy evening.
	22	.464	.588	.576	.496	72.5	77.5	82.5	66.5	2	0	1	3	NW. 2	SW. 2	0	SSW. 1	Clear, and very warm.
	23	.462	.545	.540	.499	70	79	82	67	2	0	0	2	0	SW. 1	SW. 1	WSW. 3	Pleasant; very warm.
	24	.619	.606	.566	.589	74	87.5	89.5	82	0	0	0	0	SSE. 3	0	SE. 1	SW. 1	Very warm and sultry.
	25	.643	.566	.538	.454	65	75.5	80	73	0	0	0	0	S. ½	0	0	0	Clear and very warm.
	26	.510	—	.458	.464	71.5	—	92.5	73.5	0	—	0	2	0	—	S. 1	0	Clear; cool and cloudy at evening.
	27	.513	.598	.475	.474	55	64.5	87.5	78	8	2	1	0	0	0	S. 3	S. 1	Heavy gusts of south wind in morning; clear and warm.
	28	.557	.551	.462	.494	67.5	76	84.5	79	0	0	0	0	0	0	S. 2	0	Pleasant; clear.
	29	.483	467	.373	.322	61.5	69.5	84	72.5	0	0	0	0	0	0	S. 1	W. 2	Cool; clear and warm.
	30	.385	.390	.391	—	53.5	66	74.5	—	2	0	2	—	0	0	W. 3	—	Clear and cool.
	31	.580	—	.010	.572	73.5	—	77	61.5	0	—	0	0	E. 1	—	0	0	Clear and cool.
Means....		26.555	26.561	26.498	26.495	65.2	71.6	80.0	70.6	......	......	......	......	....	....	....	....	

Monthly mean temperature, 71°.9; monthly mean of barometer, 26.525 inches.

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of August, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.		Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.				Wind, direction and force.				Daily remarks on the weather.
		7 a. m.	9 a. m.	2 p. m.	7 p. m.	7 a. m.	9 a. m.	2 p. m.	7 p. m.	7 a. m.	9 a. m.	2 p. m.	7 p. m.	7 a. m.	9 a. m.	2 p. m.	7 p. m.	
Aug.	1	—	26.762	26.508	26.418	—	65	85.5	68.5	—	0	0	0	—	0	S. 3	0	Clear and warm.
	2	26.657	.641	.550	.597	73	77.5	84.5	69.5	0	0	0	0	ESE. 1	0	WSW. 2	0	Pleasant, clear and warm.
	3	.702	.585	.515	.516	63.5	81	89	73.5	0	0	0	2	S. 2	0	0	0	Very warm.
	4	.509	.496	.456	.492	68.5	75	96	73.5	0	0	3	4	0	0	SW. 1	0	Very warm and sultry; evening cloudy.
	5	.529	.542	.491	.486	63	73	86.5	70	9	10	0	0	0	0	0	0	Cloudy and cool; hazy and sultry.
	6	.659	.662	.565	.601	65	75	86.5	75.5	0	0	0	10	0	0	W. 1	0	Warm, smoky; cloudy at evening.
	7	.546	.540	.564	.522	66	74.5	73.5	65	10	9	10	9	0	0	N. 3	0	Cloudy; threatening rain.
	8	.556	.570	.594	.528	62	65	73.5	62.5	4	10	4	0	SW. 2	0	S. 1	0	Heavy thunder-storm in night; cloudy and cool.
	9	.500	.475	.259	.299	69	74.5	82	67	0	0	3	1	0	0	0	0	Pleasant; warm.
	10	.414	.494	.403	.407	75.5	75	79	71.5	2	2	5	5	0	W. 1	WSW. 3	0	Nearly clear; cloudy at evening.
	11	.569	.576	.576	.557	76	74.5	80	67	2	2	0	0	SW. 1	SW. 2	0	0	Cool and pleasant.
	12	.569	.604	.570	.466	72.5	75	65	76	0	1	1	2	1	0	SSW. 1	NW. 2	Clear and warm.
	13	.591	.582	.500	.530	65	81	89	74	1	1	1	0	0	0	S. 2	W. 1	Clear and warm.
	14	.741	.741	.662	.567	68	73	83.5	74	0	0	1	3	0	0	NW. 1	WNW. 1	Pleasant; hazy in p. m.
	15	.720	.736	.595	.561	68.5	72	86	73	2	1	0	0	0	0	NW. 1	0	Hazy; pleasant; clear and warm.
	16	.721	.721	.571	.542	76	78	88	69.5	0	0	1	2	0	0	0	0	Misty at times; pleasant.
	17	.510	.469	.329	.191	65	71	91.5	80	2	9	7	6	0	0	W. 2	0	Warm and cloudy.
	18	.344	.339	.208	.196	68	76	93.5	77	0	0	0	4	0	0	0	SW. 1	Smoky; clear and pleasant.
	19	.225	.222	.192	.200	64.5	70	80.5	75	2	0	0	2	0	NW. 3	W. 1	W. 2	Pleasant; air smoky.
	20	.356	.362	.255	.317	65	70	82	76.5	3	2	3	10	0	0	0	NW. 2	Light clouds; cloudy.
	21	.380	.378	.347	.369	59	65	69.5	68	10	10	10	2	0	0	0	SW. 3	Cloudy; high wind; drops of rain at evening.
	22	.474	.471	—	.411	64.5	78	—	71	2	0	—	3	0	0	—	NW. 2	Nearly clear; cool.
	23	.409	.419	.400	.435	60	63	67.5	63	10	10	10	4	0	NW. 1	0	N. 1	Raining slowly from 6 a. m. throughout day and night.
	24	.547	.559	.477	—	57	62	71.5	—	4	9	2	—	0	NW. 1	0	—	Cloudy and cool.
	25	.484	.455	.413	.357	59	61	65	60	9	1	3	0	0	0	0	0	Clear and pleasant; heavy showers at 2 to 4 p. m.; air very clear.
	26	.408	.384	.310	.289	75	75.5	85.5	68	0	0	0	2	0	0	0	W. 1	Clear; warm and pleasant.
	27	.365	.398	—	.322	77.5	80.5	—	76.5	0	0	—	1	0	0	—	W. 1	Scattered clouds at evening.
	28	.466	.471	.427	.435	66.5	71	74.5	66	3	2	2	0	W. ½	W. ½	W. ½	W. 2	Partially cloudy; heavy thunder shower at 12½ p. m., passing at N.
	29	.599	.555	.425	.496	72.5	73.5	71	71	0	0	0	0	0	W. ½	0	0	Clear; clouds at evening.
	30	.433	.398	.201	.436	63.5	74.5	76.5	57.8	3	0	5	10	W. ½	0	0	0	Rain at 6 a. m. and in night; rain at 2 p. m. and through p. m., with heavy thunder and lightning.
	31	.436	.457	.427	.402	58	61.5	69.5	67	8	5	3	2	W. 1	W. 1	0	0	Rain up to 6 a. m.; cool and cloudy; pleasant.
Means....		26.515	26.515	26.444	26.424	66.9	72.3	81.1	70.3	......	......	......	......	....	....	....	....	

Monthly mean of temperature, 72°.6; monthly mean of barometer, 26.474 inches.

Observations made at Cantonment Stevens, St. Mary's Valley, for the month of September, 1854, by F. H. Burr, of Lieut. Mullan's party.

Date.	Barometer corrected.				Open air thermometer.				Cloudiness, in tenths.				Wind, direction and force.				Daily remarks on the weather.
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	7 A. M.	9 A. M.	2 P. M.	7 P. M.	
Sept. 1	26.409	26.397	26.348	26.349	61	58	66.5	63	3	8	2	3	0	0	0	SW. 2	Cold and damp, sprinkling rain; thunder at 1 p. m.; pleasant evening.
2	.421	.414	.357	.381	58	61.5	64.5	57	6	6	9	10	0	0	0	0	Rain during night; cloudy, cool and pleasant.
3	.397	.385	.380	.391	50	52	53	50.5	10	10	10	10	0	0	0	0	Cloudy and cold; rain at 6½ to 7½ p. m.; cloudy and damp.
4	.376	.376	.385	.426	58	62	54.5	53	0	0	10	5	W. 1	0	0	0	Clear; rain at 12 m. with thunder; rain at intervals during p. m.
5	.577	.562	.494	.513	50.5	56	62	54.5	10	5	0	10	W. 1	W. 2	W. 3	0	Cold and cloudy; clear; cloudy and sprinkling rain in p. m.
6	.569	.574	.577	—	50	52	51	—	10	10	10	—	0	W. 1	W 1	—	Cloudy and cool, slight rain; slight rain in p. m.
7	.573	.541	.497	—	50.5	54	56	—	5	5	10	10	0	0	0	—	Cool and cloudy; thunder and rain at 2 p. m., and in evening.
8	.568	.540	.495	.468	54	61.5	65.5	56	5	2	0	0	0	0	0	0	Cloudy; clearing cool.
9	.521	.512	.384	.429	62.5	65.5	68	58.5	1	0	5	3	0	0	0	W. 1	Scattered clouds; pleasant; slight rain in night.
10	.467	.470	.440	.445	60.5	64.5	66.5	53	0	0	5	0	0	0	W. 1	0	Clear; threatening rain in p. m.
11	.435	.446	.400	.402	59	56.5	60.5	51.5	2	2	5	5	0	0	0	0	Pleasant; moderate rain at 2 to 3 p. m.
12	.418	.410	.415	.426	57.5	57.5	55	51	2	3	10	10	0	0	0	0	Pleasant; rain at 12 m., and again at 6 to 10 p. m.
13	.579	.567	.527	.525	49	54.5	59	49	10	10	10	0	0	0	0	0	Cloudy; pleasant; nearly clear.
14	.564	.539	.444	.412	53	58.5	66	57.5	0	0	0	0	0	0	0	0	Mild and pleasant.
15	.453	.438	.426	.465	49.5	57.5	59.5	54	3	5	8	5	W. 1	0	0	0	Cloudy, appearance of rain; rain from 12 m. during p. m.
16	.564	.584	.577	.548	53.5	54.5	60	52.5	8	8	4	8	0	0	0	0	Rain during night; cloudy and damp.
17	697	.526	.578	.593	49	51	61.5	58	8	5	5	5	0	0	0	0	Cloudy and unpleasant.
18	.650	—	—	—	52.5	—	—	—	4	—	—	—	0	—	—	—	Partially cloudy.
Means....	26.511	26.490	26.453	26.452	54.4	57.5	60.4	54.6	......	......	......	......	....	....	....	....	

Monthly mean of temperature, 56°.7; monthly mean of barometer, 26.476.

NOTE.—Observations were also made with Green's open cistern barometer at this post from March to May inclusive. Its readings were near two-tenths of an inch below those here recorded, and appear inaccurate.

Summary of Barometric and Temperature Observations at Cantonment Stevens.

Latitude 46° 20′ 10″; longitude 113° 55′; altitude above sea 3412.5 feet.—From mean of all the observations of barometer No. 769.

Date.	Barometric means, No. 769.					
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	Mean.
1853.						
October (21 days*)	26.547	....	26.530	....	26.522	26.534
November	.382	....	.380	....	.387	.383
December	.502	....	.496	....	.490	.496
1854.						
January	.498	....	.449	....	.466	.471
February	.427	....	.416	....	.414	.419
March	.412	26.419	.396	26.383	.408	.403
April (first 15 days)	.578	.587	.533	.504	.511	.542
May	.430	.418	.364	.365	.389	.393
June	.429	.433	.368	.368	26.406	.401
July	.553	.551	.498	.495	....	.575
August	.515	.515	.444	.424	....	.474
September (17 days)	26.511	26.490	26.453	26.452	....	26.476

Date.	Temperature means.							
	7 A. M.	9 A. M.	2 P. M.	7 P. M.	9 P. M.	Mean.	Max.	Min.
1853.	°	°	°	°	°	°		°
October (21 days)	39.5	....	53.6	....	44.5	45.9	69	20
November	32.5	....	38.6	....	31.2	34.1	57	17
December	28.1	....	35.4	....	27.0	30.2	55	3
1854.								
January	12.1	....	16.0	....	11.8	13.3	52	—29
February	29.1	....	37.4	....	28.9	31.8	46	14
March	37.5	41.9	46.8	36.7	33.4	39.3	61	22.5
April*	45.9	49.4	54.0	49.7	42.5	48.3	74	31
May	53.9	59.8	62.7	56.3	49.3	56.3	80	36
June	62.7	67.1	71.5	63.7	56.3	64.2	86	49.5
July	65.2	71.8	80.0	70.6	....	71.9	94.5	53.5
August	66.9	72.3	81.1	70.3	....	72.6	96	56
September (17 days)	54.4	57.5	60.4	54.6	....	56.7	69	49

Mean of all—at 7 a. m., 26.482; 2 p. m., 26.444; 9 p. m., 26.448; mean, 26.457

At "Horse Guard Camp," April 15 to 30, 1854—7 a. m., 26.204; 9 a. m., 26.214; 2 p. m. 26.125; 7 p. m., 26.152; 9 p. m., 26.163; mean, 26.172.

Means for the year—spring, 47°.97; summer, 69°.57; autumn 45°.57; winter, 24°.90; year, 47°.

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* Last 15 days at "Horse Guard Camp."

Summary of Meteorological Observations at Fort Pierre, Missouri River.

Date.	Mean temperatures.						Days rain.	Days snow.	Remarks.
	7 a. m.	2 p. m.	9 p. m.	Mean.	Maximum.	Minimum.			
	°	°	°	°	°	°			
July, 1854	69.45	85.26	76.06	76.92	97	63	7	0	Amount of rain considerable.
August, 1854	71.93	91.16	81.33	81.50	108	60	6	0	Amount of rain considerable. Thermometer above 106° on 6 days, 18th to 23d, and 28th.
September, 1854.	62.33	79.80	69.66	71.15	98	51	8	0	Amount of rain considerable. Very warm at the close of the month.
October, 1854 ...	47.22	72.35	60.22	59.78	94	30	3	0	Amount of rain small. Cold from 13th to 18th. Warm at 5th, and on 26th to 29th.
November, 1854..	30.90	50.10	40.66	40.50	78	10	0	2	Amount of precipitation very small. Coldest at 11th.
December, 1854..	23.30	40.71	32.90	32.00	61	— 1	1	2	Amount of precipitation very small.
January, 1855....	13.80	24.90	19.61	19.17	50	—12	1	4	Amount of precipitation considerable. Below zero 3d, 4th, 7th, 13th, and 21st to 23d.
February, 1855...	15.64	29.39	24.25	22.51	57	—11	1	4	Amount of precipitation small. Below zero 21st to 27th.
March, 1855.....	24.61	46.06	36.55	35.33	70	2	1	2	Amount of precipitation very small. Coldest at 19th.
April, 1855......	45.23	69.36	57.19	57.30	96	22	1	0	Amount of precipitation very small. Coldest at 10th. Very warm at the close.
May, 1855.......	55.74	75.20	63.71	60.47	92	46	8	0	Amount of precipitation large. Cold at 22d to 24th.

Observations by Fred. Behman. Latitude given as 44° 23′ 28″. Altitude, by Nicollet, 1,450 feet.

Summary of Barometric and Temperature Observations at Columbia Barracks, Oregon, from July to December, 1853, and for four months of 1854.

	Temperatures.							Amount of rain.
	Sunrise.	9 a. m.	3 p. m.	9 p. m.	Mean.	Maximum.	Minimum.	
	°	°	°	°	°	°	°	*Inches.*
July, 1853............	61.33	71.60	80.92	69.47	70.83	91	82	0.30
August, 1853	56.52	62.80	74.00	63.06	64.10	84	43	0.39
September, 1853	50.53	58.57	70.13	58.47	59.42	84	42	2.00
October, 1853	46.39	54.97	62.00	51.59	53.74	82	28	3.66
November, 1853.......	42.80	46.16	48.86	43.63	43.57	59	31	11.57

NOTE.—The temperature observations at Columbia Barracks (Fort Vancouver) are from the record kept at the military post. For use of the survey, they were copied to the close of November, 1853.

Daily and Monthly Barometric Means at Columbia Barracks, 1853.

Observations at sunrise, 9 a. m., 3 p. m., and 9 p. m. Readings corrected to 32°.

No.	July.	August.	September.	October.	November.
1	—	30. 051	29. 618	30. 026	30. 185
2	—	. 097	. 709	. 036	. 150
3	—	. 037	. 891	29. 968	. 271
4	—	29. 960	30. 150	. 915	. 205
5	—	. 981	. 034	30. 031	29. 880
6	—	. 971	29. 951	. 049	. 816
7	—	30. 016	. 847	29. 897	. 913
8	—	. 098	. 729	. 843	30. 013
9	—	. 119	. 757	. 652	29. 934
10	—	29. 951	. 882	. 728	. 709
11	—	. 799	30. 003	. 672	. 916
12	—	. 804	29. 741	. 989	. 687
13	—	. 924	. 732	30. 075	. 810
14	—	. 843	. 558	29. 908	30. 116
15	—	. 782	. 532	. 921	. 120
16	—	. 919	. 642	. 902	29. 904
17	—	. 907	. 824	. 823	. 817
18	—	. 952	30. 043	30. 009	. 738
19	30. 082	. 985	29. 974	. 137	. 772
20	. 010	30. 047	. 908	. 275	. 824
21	29. 822	29. 957	. 874	. 164	. 787
22	. 829	. 863	. 796	. 175	30. 165
23	30. 037	. 874	. 710	. 012	29. 905
24	29. 989	. 873	. 753	29. 874	. 814
25	. 855	. 836	. 925	30. 047	. 394
26	. 807	. 818	. 876	29. 936	*. 134
27	. 845	. 840	. 883	30. 183	—
28	. 864	. 837	30. 010	. 253	—
29	. 835	. 797	29. 947	. 198	—
30	. 980	. 775	. 914	. 080	—
31	30. 014	. 834	—	. 235	—
Monthly mean at sunrise	29. 951	29. 940	29. 866	30. 103	29. 878
Monthly mean at 9 a. m.	29. 940	29. 947	29. 854	30. 101	29. 870
Monthly mean at 3 p. m.	29. 887	29. 886	29. 826	30. 098	29. 924
Monthly mean at 9 p. m.	29. 905	29. 897	29. 842	30. 098	29. 925
Mean	29. 921	29. 917	29. 847	30. 100	29. 899

Mean for 131 days, 29. 939 inches. Altitude of Columbia Barracks, 57. 6 feet.

* A remarkably low point, occurring at all Pacific stations. Two observations only, at sunrise and 9 a. m.

The barometric observations at Olympia are of a barometer noted by G. W. Stevens as containing air, in April, 1854. They have a large zero error, and the succession of readings is often such as to prove that the errors of measurement are very large. The summaries would, therefore, give no valuable data to judge of the mean position of the barometer then, or of the measures of variation.

The hygrometric observations are not embraced in the summary, as they can only be presented accurately in deduction, or in detailed observations. The mean differences of the wet and dry bulb are very small. In August, 1854, the mean difference at sunrise is but one and a half degrees, at 2 p. m. 7.5 degrees, at 9 p. m. 3.2 degrees. In September, 1854, these differences are, for the respective hours, 1.4, 4.3, and 1.5 degrees. These are the dryest months except July. It will be seen that these results differ largely from the same measures east of the Cascade range of mountains and at Fort Benton, and prove the coast atmosphere to contain a large proportion of moisture at all seasons. In the rainy months, the differences between the hygrometer and the dry thermometer are very small.

Summary of Meteorological Observations at Olympia, Washington Territory.

Date.	Thermometer.						Days of rain.	Days clear.	Remarks.
	7 a. m.	2 p. m.	9 p. m.	Mean.	Maximum.	Minimum.			
	°	°	°	°	°	°			
April, 1854	44.9	57.1	49.6	50.53	72	34.5	24	0	Profuse and almost constant rains. Frost on the 8th, 11th, 21st, and 25th; wind irregular, mainly south to west and north, and light.
May, 1854	48.2	63.2	53.1	54.80	83	41	8	8	Irregular and moderate rains. Heavy white frost on 13th; winds light, and very irregular.
June, 1854	54.0	64.0	57.0	58.33	74.5	49	15	7	Frequent irregular rains. Wind very variable; but few clear days.
July, 1854	55.0	75.9	64.0	65.00	89.4	45	0	20	Very slight rain on 15th; winds north and northwest mainly, light; mostly clear from 7th to 27th.
August, 1854	55.5	74.2	65.5	65.07	86.5	48	7	9	1.83 inches of rain. Much cloudy weather; winds very light and irregular.
September, 1854	53.1	69 0	56.9	59.67	84.5	45	6	8	1.36 inches of rain. Rains and winds irregular; generally cloudy.
October, 1854	45.3	60.2	48.7	51.40	73	38	13	6	3.14 inches of rain; rains nearly continuous from the 20th; winds south and southeast. Heavy frost on 6th, 7th, 8th, and 9th, and on 12th and 13th.
November, 1854	43.0	51.9	45.5	46.80	67	32	12	3	3.91 inches of rain; winds principally south and southwest. Rains nearly continuous from 17th to 24th; no snow.
December, 1854	39.7	46.0	42.0	42.57	58	31	15	3	11.32 inches rain; rains nearly continuous from 20th. A little snow on 26th; winds south and southwest.
January, 1855	38.9	45.7	40.4	41.67	57	26	18	2	16.62 inches of rain. Three days snow, six inches in depth on 4th; winds south or southward during rains and snows.
February, 1855*	41.0	49.7	44.3	45.00	62	34.5	9	0	Amount of rain not measured. First part of month generally cloudy and rainy.

* Observations to 17th only.

BAROMETRIC AND METEOROLOGICAL OBSERVATIONS, MADE DURING THE SURVEY OF A LINE FROM COLUMBIA BARRACKS TO FORT COLVILLE, AND THE RETURN; BY LIEUTENANT S. MOWRY, U. S. ARMY.

Comparison of barometers.—The mercurial barometers are designated as "standard," "No. 1" and "No. 2;" the first of which was left at Columbia Barracks and regularly observed for nearly five months. The mean of its readings for this period gives quite accurately the known altitude of Columbia Barracks above the sea, and it may therefore be taken as without zero error, though no comparison of it with an absolute standard exists. Barometer "No. 1" reads so nearly with this "standard" from July 1st to July 18th, the time of departure, that no zero correction need be introduced. This barometer is carried nearly to Fort Okinakane, and may be used for all the determinations of altitude. Barometer "No. 2" differs considerably at Columbia Barracks from either, and continues to differ as far as it is carried, which is to camp 28, "on the north branch of the Columbia," by between two and three tenths of an inch. It is doubtless nearly so much in error; and as its readings do no appear necessary to any determination, they are not given in the tables.

The aneroid barometers, Nos. 9445 and 7992, are compared at Columbia Barracks and used after the mercurial instruments are broken. Their readings are quite irregular, and Lieut. Mowry places little confidence in them. When they have an approximate accuracy or possible value, they are transcribed with the journal, but no altitudes are computed from them. At the return of the party they differed from the "standard" by very large measures.

Barometers "No. 1" and "No. 2" were syphons. It does not appear whether the "standard" was an open cistern, (brass,) or Alexander's mountain barometer, the vernier of which is adjusted to a glass column only. The correction for temperature is somewhat less in this case than for an open cistern with brass scales. The correction for brass scales is, however, applied to all the readings of the barometer retained at Columbia Barracks as the "standard."

Barometric Readings at Columbia Barracks.

Date.	Hour.	Standard.	No. 1.	Attached therm.	Air thermometer.	Wet-bulb.	Remarks.
July 2	8 a. m.	30.150	30.198	63	63.9	....	Fair.
	12 m.	.160	.170	71	69.8	60.2	Day fine; Mount Hood covered with snow, distinctly visible; distant 40 miles. Mount Jefferson also visible; distant 100 miles.
	4 p. m.	.140	.238*	74	71.8	61.5	
	8 p. m.	.130	.126	67	69	57.5	
3	4 a. m.	.150	.136	56	69	58.5	Fair.
	8 a. m.	.210	.260	60	61	55	Do.
	12 m.	.140	.173	72	70	59	Do.
	4 p. m.	.100	.150	78	79	66	Do.
	8 p. m.	.110	.096	71	74.5	61.5	Do.
4	8 a. m.	.040	.050	64	68	59.5	Do.
	12 m.	.200*	.002*	76	78	66	Do.
	4 p. m.	.200*	.000*	86	86	68	Cloudy.
5	8 a. m.	.000*	.241*	62	62	56.5	Do.
	12 m.	.265	.260	65	65	55	Fair.
	4 p. m.	.241	.240	69.5	69.5	58	Do.
6	8 a. m.	.260	.218	59.5	60	54	Do.
	12 m.	.220	.224	68.5	68	58	Do.
	4 p. m.	.140	.163	78	78	61.5	Do.
7	8 a. m.	.000	.000	66.5	70	61.5	Do.
	4 p. m.	29.900	30.029	86.5	86	64.5	Do.
	8 p. m.	29.980	29.952	74	74	63	Do.
8	8 a. m.	30.410*	30.110	65	66	60	Do.
	12 m.	.100*	.021	76.5	76	61	Do.
	4 p. m.	.040	.168	83.5	83	66	Do.
	8 p. m.	.060	.050	70	70.5	57	Do.

Barometric Readings at Columbia Barracks—Continued.

Date.		Hour.	Standard.	No. 1.	Attached therm.	Air thermometer.	Wet-bulb.	Remarks.
July	9	8 a. m	30.200	30.218	57.5	58	52.5	Pleasant.
		12 m	.200	.256	68	68	59	Do.
		4 p. m	.130	.180	70.5	70.5	61	Do.
		8 p. m	.130	.150	66.5	68	58.5	Do.
	10	8 a. m	.100	.137	61.5	62	57	Do.
		12 m	.090	.110	65.5	65.5	59	Rainy; wind N.W.
		4 p. m	.050	.128	63.5	63.8	57.5	Rain at intervals; quantity .125 inch.
	11	8 a. m	.050	.071	57	57	53	Cloudy; wind south.
		12 m	.110	.130	61.8	62.2	57	Rain at intervals.
		4 p. m	.120	.139	58.4	58.5	54.2	Cloudy; wind S.W.
		8 p. m	.140	.157	57.5	58.0	55	Rain, with lightning; (very rare.)
	12	12 m	.280	.258	64.2	64	57	Cloudy; south wind.
		4 p. m	.230	.245	69.5	69	60.2	Cloudy; amount of rain in last 24 hours, .175 inch.
		8 p. m	.220	.227	63.5	64.5	57	Smoky; fair.
	13	8 a. m	.140	.150	56.5	56.7	52	Cloudy; west wind.
		12 m	.100	.163	70.5	70	61	Fair.
		4 p. m	.060	.059	78	77.2	62.2	Fair, smoky.
		8 p. m	.030	.040	67	68.5	61	Fair.
	14	8 a. m	.140	.100	65.5	65.5	59	Do.
		12 m	.140	.144	76	75.5	62.5	Smoky; wind south.
		4 p. m	.120	.128	81	80.7	65	Fair.
		8 p. m	.100	.101	74.5	75	64	Fair; smoky.
	15	8 a. m	.080	.090	67.5	68	62	Fair; wind west.
		12 m	.050	.080	80	79	67.5	Do.
		4 p. m	.000	.030	85.2	85	70.2	Do.
		8 p. m	.000	.003	75	76	65.7	Fair; wind north.
	16	8 a. m	.120	.101	62.5	62	59	Rainy; wind S.E.
		12 m	.100	.104	65.7	66	62	Cloudy; wind S.E.
Mean of 48 observations			30.120	30.130				

NOTE.—Several of these observations are obvious errors of reading. Those marked * are rejected in the comparison.

Barometric and Meteorological Observations on route from Columbia Barracks to Fort Colville.

Locality and date.		Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
First Plain, Camp No. 1.								
July	20	Sunrise	30.040	62.5	29.976	—	W	Two miles from Columbia barracks.
	20	8 a. m	.000	73.4	.880	73.5	W	Smoky.
	20	9 a. m	29.991	77	.861	77	W	Fair.
	20	10 a. m	.991	78	.858	79.5	W	Fair.
	20	12 m	.999	82.5	.855	81	W	Pleasant.
	20	1 p. m	30.003	85	.852	83.5	W	Pleasant.
	20	2 p. m	29.970	88.5	.810	88.5	NE	Fair.
	20	3 p. m	.938	89.5	.775	88.5	NE	Fair.
	20	4 p. m	.959	87.5	.801	83	NE	Fair.
	20	5 p. m	.890	80.5	.751	79	NE	Fair.
	20	6 p. m	.855	76.5	.727	76.5	NE	Fair.
	20	7 p. m	.958	73	.839	72	NE	Pleasant.
	21	Sunrise	.920	50.5	.861	50	NE	Fair.
	21	6 a. m	.850	67.5	.746	60	NE	Fair.
Mean					29.828	74.6		
Camp No. 2, Callissis or Fourth Plain.								
July	21	3 p. m	30.000	98	29.814	98.5	W	Very clear and dry.
	21	5 p. m	29.797	98	.612	99	W	Very clear and dry.

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
July 21	6 p. m	29.754	94	29.580	93	SW	Very clear and dry.
21	7 p. m	.758	88	.600	88	SW	Pleasant.
21	8 p. m	.712	81.5	.571	84	0	Pleasant.
22	Sunrise	.742	65	.645	66	S	Cloudy.
22	6 a. m	.764	69	.656	69	S	Clear; smoky.
22	9 a. m	.723	73	.605	75	SW	Clear; smoky.
22	12 m	.721	87	.546	87	0	Few clouds.
22	3 p. m	.826	91	.660	90	SW	Few clouds.
22	9 p. m	.900	84	.751	85	NW	Fair.
23	Sunrise	.870	53.5	.804	54.2	NW	Cloudy.
23	8 a. m	.940	63.5	.847	63.7	NW	Cloudy.
23	12 m	.958	78	.825	79.8	NW	Pleasant; smoky.
23	3 p. m	.948	86.5	.793	86.5	SW	Fair.
23	6 p. m	.918	84.3	.768	84.2	NW	Fair.
23	7¾ p. m	.912	76.2	.785	77.5	NW	Fair.
24	Sunrise	.880	49.5	.824	51	0	Foggy.
Mean				29.706	79.3		
Camp McClellan, No. 3.							
July 24	1 p. m	29.940	83	29.794	83	W	Clear.
24	5 p. m	.868	87	.712	86.5	NW	Fair.
24	7¾ p. m	.781	67.5	.677	66.3	NW	Fair.
25	Sunrise	30.300*	45.5	30.254	46	NE	Foggy.
Mean				29.728	78.6		
Camp No. 4.							
July 25	7 p. m	29.530	66.5	29.433	68	NW	Fair.
26	Sunrise	.474	45.5	.429	45	NW	Fair.
26	9 a. m	.552	79.5	.418	79.5	NW	Fair.
26	12 m	.553	88.5	.395	87	NW	Fair.
26	3 p. m	.516	100	.328	94.5	W	Smoky.
26	6 p. m	.474	86	.323	84	0	Smoky.
27	Sunrise	.562	45.5	.517	44	W	Heavy dew; clear.
27	8 a. m	.574	80	.438	74	W	Clear.
Mean				29.410	72		
Camp No. 5.							
July 27	3 p. m	29.352	86	29.262	84	SW	Fair.
27	6 p. m	.342	72	.198	74	S	Fair.
28	Sunrise	.304	45.5	.259	46.2	SW	Foggy.
28	9 a. m	.420	75.5	.297	74.8	SW	Smoky.
28	12 m	.410	85	.261	83	SE	Fair.
28	3 p. m	.364	86	.213	84.5	S	Fair.
28	6 p. m	.388	71.5	.275	70.5	0	Pleasant.
29	Sunrise	.270	44.5	.228	45.5	SW	Fair; heavy dew.
29	9 a. m	.382	73.5	.264	71.7	SE	Fair; smoky.
29	12 m	.378	81	.240	79.7	S	Fair.
29	3 p. m	.358	85.5	.208	83	0	Fair.
29	6 p. m	.350	71.5	.237	71	W	Fair.
29	9 p. m	.288	59.2	.208	59	W	Fair.
30	Sunrise	.312	47.7	.261	46.8	W	Foggy. Temperature of stream at Camp 5, Yabkotl plain, at 9 a. m., 69°; at sunrise, 59°.
30	7 a. m	.370	61.7	.283	61.5	SW	Fair.
30	9 a. m	.396	69.5	.288	69	SW	Fair.
30	12 m	.402	77.5	.273	77	0	Fair.
30	3 p. m	.381	79.2	.250	79.5	S	Fair.
30	6 p. m	.360	70	.251	69	S	Fair; smoky.
30	9 p. m	.350	57.5	.274	57.5	S	Fair.
31	Sunrise	.380	54.5	.312	54	SE	Cloudy.
Mean				29.251	68.5		

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Camp No. 6.							
July 31	12 m.	29.678	72.2	29.562	72.7	SW.	Fair.
31	3 p. m	.658	76.5	.531	76	SW.	Fair; smoky.
31	6 p. m	.596	66	.497	65	0	Fair.
31	7¼ p. m	.588	61.7	.500	61.5	SE.	Fair.
31	9 p. m	.580	54.7	.510	54.8	SE.	Smoky; clouds.
Aug. 1	Sunrise	.560	38.5	.531	39	SE.	Foggy; heavy dew.
1	7 a. m	.640	51.5	.579	51	SE.	Foggy.
1	8 a. m	.642	56	.569	54.5	SE.	Fair.
Mean				29.535	59.3		
Camp No. 7.							
Aug. 1	5 p. m	29.584	66	29.485	68	S.	Clear.
1	7 p. m	.610	65.5	.512	68	0	Fair: smoky.
1	9 p. m.	.622	59.7	.539	59.5	S.	Fair; smoky.
2	Sunrise	.686	45	.642	48.2	S.	Cloudy.
2	7 a. m.	.634	54.4	.566	55	S.	Cloudy.
Mean				29.549	59.7		
Camp No. 8.							
Aug. 2	3 p. m.	29.790	71.2	29.677	69.5	SE.	Fair.
2	6 p. m.	.766	67.2	.663	67	NE.	Clear.
2	9 p. m.	30.320*	59.5	.235*	59	NW.	Light dew; foggy.
3	Sunrise	29.744	49.7	.686	49.5	0	Slight fog.
3	6 a. m.	.744	53	.679	53	0	Cloudy.
3	7 a. m.	.758	54.5	.690	54.5	0	Cloudy.
3	8 a. m.	.764	58.5	.684	57.7	0	Cloudy.
Mean				29.680	56.9		
Camp No. 9.							
Aug. 3	5 p. m.	29.400	77.5	29.271	76.5	W.	Fair.
3	6 p. m.	.368	67.7	.264	67.2	W.	Fair.
3	7 p. m.	.362	63.5	.270	63.2	W.	Fair.
3	9 p. m.	.594	58	.516	58	0	Fair.
4	Sunrise	.402	48	.350	47	W.	Fair.
4	6 a. m.	.394	50	.337	49.5	SE.	Fair.
4	7 a. m.	.430	59	.350	58.5	SE.	Fair.
Mean				29.337	60		
Camp No. 10.							
Aug. 4	7 p. m.	29.228	71.5	29.115	71	S.	Fair.
4	9 p. m.	.208	61	.123	61.7	S.	Fair.
5	Sunrise	.228	48.5	.175	49	S.	Fair.
5	7 a. m.	.320	52.5	.257	53	S.	Fair.
Mean				29.167	58.7		
Camp No. 11.							
Aug. 5	3 p. m.	27.102	72.5	26.996	72	SW.	Fair.
5	5 p. m.	.190	69.2	27.091	69.2	SW.	Fair.
5	7 p. m.	.120	54	.058	55	S.	Fair.
5	9 p. m.	.131	49	.081	49	S.	Fair.
6	Sunrise	.086	43.5	.050	44.5	S.	Foggy.
6	7 a. m.	.112	55	.048	55	0	Foggy.
6	8 a. m.	.124	62	.049	59.5	NW.	Fair.
Mean				27.053	57.7		

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Camp No. 12.							
Aug. 6	5 p. m.	26.960	66	26.870	64.5	W.	Fair.
6	7 p. m.	.856	52.5	.799	52	0	Fair.
6	9 p. m.	.860	44.5	.822	45.7	W.	Fair.
7	Sunrise	.864	51.5	.810	51.5	W.	Raining.
7	8 a. m.	.860	52	.803	53	0	Misty rain.
7	12 m.	.970	77.5	.852	76.5	W.	Cloudy.
7	3 p. m.	.914	58.5	.842	57.5	W.	Cloudy.
7	6 p. m.	.880	52.5	.822	53	NW.	Cloudy.
7	7 p. m.	.878	48	.831	48	0	Cloudy.
7	9 p. m.	.874	41.5	.843	42	W.	Cloudy.
8	5 a. m.	.900	44.5	.862	44	W.	Cloudy.
8	7 a. m.	.904	50.5	.851	51.7	NW.	Cloudy.
Mean				26.834	53.3		
Camp No. 13.							
Aug. 8	4 p. m.	26.020	45	25.982	45	S	Fair.
8	5 p. m.	.028	44.5	.991	45	S	Fair.
8	7 p. m.	25.998	40	.971	40	S	Cloudy.
8	9 p. m.	26.002	39	.978	39	S	Cloudy.
9	Sunrise	.014	39.5	.989	39.7	N.	Clear.
9	7 a. m.	.066	54	26.007	50	N.	Clear.
9	9 a. m.	.070	53	.013	53.2	N.	Pleasant; clouds.
9	12 m.	.116	54	.057	54.5	NW.	Pleasant.
9	3 p. m.	.090	59	.019	59	NW.	Pleasant.
9	6 p. m.	.070	54	.011	52.5	S	Clear.
9	7 p. m.	.050	47.8	.005	47.7	S	Fair.
9	9 p. m.	.016	38	25.999	38	S	Fair.
10	5 a. m.	.022	34	26.009	31	N.	Clear.
10	7 a. m.	.036	57.2	25.970	54.5	N.	Fair.
10	9 a. m.	.022	56.3	.958	55.7	NE.	Pleasant; cumulous clouds
10	12 m.	.020	61	.945	60	NE.	Fair.
10	7 p. m.	25.930	49.5	.880	50	W.	Fair.
10	9 p. m.	.916	44	.880	44.5	0	Fair.
11	Sunrise	.888	40	.861	41.2	E.	Fair.
11	7 a. m.	.896	57.5	.829	56		Fair.
Mean				25.968	48		
Camp No. 14.							
Aug. 11	7 p. m.	27.730	62	27.617	62	SE	Fair; clouds.
11	9 p. m.	.834	53	.774	53	SE	Pleasant.
12	Sunrise	.850	43	.814	43	W.	Cloudy.
12	7 a. m.	.820	55	.754	54	W.	Pleasant.
Mean				27.747	53		
Camp No. 15.							
Aug. 12	3 p. m.	28.046	81	27.915	82	SW.	Pleasant; clouds.
12	6 p. m.	.002	68	.903	67.5	SW.	Pleasant.
12	7 p. m.	27.998	65.2	.914	65.5	SW.	Pleasant.
12	9 p. m.	.994	56.5	.924	57	SW.	Pleasant.
13	Sunrise	.970	51	.914	53	S	Pleasant; clouds.
13	7 a. m.	28.082	57	28.011	71	S	Cloudy.
Mean				27.930	66		
Camp No. 16.							
Aug. 13	3 p. m.	28.192	80	28.063	78.7	W.	Pleasant; smoky.
13	6 p. m.	.334	72	.225	71.5	SW.	Pleasant.
13	7 p. m.	.260	68	.161	68	SW.	Fair.
13	9 p. m.	27.950*	62.5	.865	62.5	0	Fair.
14	Sunrise	.606*	37	.585	39	SW.	Fair.
14	6 a. m.	28.070	40.5	.040	42	SE	Fair.
Mean				28.122	65		

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Camp No. 17.							
Aug. 14	3 p. m.	27.190	81	27.066	81.4	N.	Fair.
14	6 p. m.	.344	72	.239	71.5	W.	Fair.
14	9 p. m.	.308	50	.255	50.5	W.	Fair.
15	Sunrise.	.290	35	.274	35.5	E	Fair.
15	6 a. m.	.300	38	.277	38	E	Fair.
Mean				27.222	55.4		
Camp No. 18.							
Aug. 15	3 p. m.	27.546*	83.5	27.411	83.5	W	Fair; smoky.
15	6 p. m.	26.776	67	.684	67	NW	Fair.
15	9 p. m.	.770	57	.701	57	0	Fair.
16	Sunrise	.872	55	.808	55	W	Fair; smoky.
16	6 a. m.	.772	55.5	.707	56	W	Fine; smoky.
Mean				27.725	58.7		
Camp No. 19.							
Aug. 16	5 p. m.	28.684	81.2	28.550	80.7	SW	Pleasant.
16	7 p m.	.680	70.5	.573	71	SW	Pleasant.
16	9 p. m.	.680	62	.595	61.5	SW	Pleasant.
17	Sunrise	.640	39	.613	39	W	Fair; slight dew.
17	7 a. m.	.734	66.5	.637	67	W	Fair.
Mean				28.594	63.8		
Camp No. 20, (Atahnam river, near the Yakima.)							
Aug. 17	6 p. m.	27.996	63.5	27.909	63.2	W	Fair.
17	9 p. m.	.972	48	.923	48	W	Fair.
18	Sunrise	.958	49.5	.906	49.5	SW	Cloudy.
18	7 a. m.	.882	53	.821	53	E	Cloudy.
18	9 a. m.	28.040	76.5	.920	76	E	Fair.
18	3 p. m.	.084	76	.965	70	W	Fair.
18	6 p. m.	.054	54.5	.989	54	W	Fair.
18	9 p. m.	.076	45.5	28.033	45	W	Clear.
19	5 a. m.	.036	47	27.990	46.5	W	Rainy.
19	9 a m.	.068	56	.999	55	W	Light rain.
19	12 m.	.074	69	.973	65	NW	Cloudy.
19	3 p. m.	.076	58.5	28.001	58	W	Cloudy.
19	6 p. m.	.062	55.5	27.995	55	W	Cloudy and rainy.
20	Sunrise	.050	37	28.029	37	W	Fair; heavy dew.
20	7 a. m.	.126	53	.065	55	W	Fair.
Mean				27.968	55.3		
Camp No. 21.							
Aug. 20	7 p. m.	28.330	54.5	28.264	57.5	W	Fair.
21	5 a. m.	.340	48.5	.290	48.5	W	Fair.
21	9 a. m.	.402	69	.300	70	W	Fair.
21	12 m.	.416	79.5	.287	79	W	Fair.
21	3 p. m.	.382	81.5	.248	78.5	E	Fair.
21	6 p. m.	.084*	55.1	.018	55	W	Fair; smoky.
21	9 p. m.	.372	58.5	.296	58	W	Fair.
22	Sunrise	.326	50.5	.270	50	E	Fair.
22	9 a. m.	.450	80	.319	82	E	Fair.
22	12 m.	.442	86	.296	83.5	E	Fair; smoky.
22	6 p. m.	.370	65	.277	65	W	Fair.
22	9 p. m.	.386	62	.301	62	W	Fair.
23	Sunrise	.420 [a]	56	.350	56	W	Fair.
23	9 a. m.	.692	76	.571	75	SE	Fair.
23	3 p. m	.670	90	.514	90	E	Fair.
23	9 p. m.	.539	54	.474	54.5	0	Fair.
24	Sunrise	.548	48	.498	48	W	Fair.
24	9 a. m.	.566	84	.425	83.5	W	Fair.

[a] The observations of barometer from this date to 29th August are of No. 2, and are not used in computation.

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Aug. 24	3 p. m.	28.496	100 (?)	28.315	100 (?)	SW	Pleasant.
24	9 p. m.	.518	57	.445	57	0	Pleasant.
25	Sunrise	.472	59	.394	58	W	Clear.
25	9 a. m.	.546	82	.410	81	W	Fair.
25	3 p. m.	.498	78	.372	78.5	E	Pleasant.
25	9 p. m.	.442	61	.352	65	0	Pleasant.
26	Sunrise	.478	58	.403	58.5	SE	Fair.
26	9 a. m.	.422	82	.286	81	E	Fair.
26	3 p. m.	.450	90	.294	88	SE	Pleasant.
26	9 p. m.	.382	72	.272	72	0	Pleasant.
27	Sunrise	.200	64	.110	65	W	Fair.
27	9 a. m.	.450	82	.314	80	W	Fair.
27	3 p. m.	.402	88	.251	88	SE	Cumulous clouds.
27	9 p. m.	.352	55.5	.283	56	W	Cumulous clouds.
28	Sunrise	.394	54	.329	54	NW.	Fair.
28	9 a. m.	.462	75	.314	73	N.	Clouds.
28	3 p. m.	.456	84	.315	84	NE	Cloudy.
28	9 p. m.	.530	64	.440	64	SW	Cloudy.
29	Sunrise	.530	52.5	.469	52	E	Fair: cumuli.
29	9 a. m.	.604	74	.488	72	E	Pleasant.
29	3 p. m.	.592	72.5	.480	73	SE	Pleasant.
29	9 p. m.	.280	64	.160	64	0	Clear.
30	Sunrise	.194	51	.130	54	W	Clear.
30	7 a. m.	.184	62	.100	62.5	W	Clear.
30	9 a. m.	.224	80	.094	80	NW.	Fair.
30	12 m.	.194	92	.035	91	W	Pleasant.
30	3 p. m.	.118	97	27.947	97	SW	Cumulous clouds.
30	6 p. m.	.030	78	.906	78	W	Cloudy.
30	9 p. m.	27.940	76	.821	76	W	Cloudy.
31	Sunrise	.966	53.5	.904	54	W	Rainy.
31	9 a. m.	.942	51	.886	51	W	Driving rain; high wind.
31	12 m.	28.050	51.5	.992	52	NW.	Rainy.
31	3 p. m.	.138	67	28.042	65	NW.	Cloudy; pleasant.
31	6 p. m.	.138	54	.074	54	NW.	Cloudy.
31	9 p. m.	.168	47.5	.120	48	NW.	Cloudy.
Sept. 1	Sunrise	.206	41	.175	41	W	Pleasant; clouds.
1	7 a. m.	.250	53	.188	53	W	Pleasant; clouds.
1	9 a. m.	.260	63	.174	62.5	SE	Pleasant; clouds.
1	12 m.	.256	71.5	.148	71	SE	Pleasant; clouds.
1	3 p. m.	.214	68	.114	67	NW.	Cloudy.
1	6 p. m.	.154	53	.093	53.5	NW.	Cloudy.
1	9 p. m.	.090	49.5	.038	49	NW.	Clear.
2	Sunrise	.150	52	.091	52	W	Cloudy.
2	9 a. m.	.174	59	.098	59	W	Cloudy; rainy.
2	12 m.	.202	66	.108	65	W	Cloudy.
2	3 p. m.	.166	62.5	.081	62.5	W	Cloudy.
2	6 p. m.	.148	55	.082	65	SE	Cloudy.
2	9 p. m.	.138	50	.084	52	SE	Cloudy.
3	Sunrise	.124	52	.065	52	W	Cloudy.
Mean.				28.131	63.5		
Yakima Valley, Camp No. 22.							
Sept. 3	6 p. m.	28.434	59	28.356	60	NW.	Cloudy.
3	9 p. m.	.464	49.5	.412	50	NW.	Cloudy.
4	Sunrise	.550	49	.498	49	NW.	Clear.
4	7 a. m.	.990 *a*	63	.901	62	N	Clear.
4	10 a. m.	.920	70	.812	64	NW.	Fair; clouds.
4	12 m.	.870	76	.748	76.5	N.	Fair; clouds.
4	3 p. m.	.834	73	.720	72	N.	Fair; clouds.
4	9 p. m.	.760	49.5	.706	49	0	Fair; clouds.
5	Sunrise	.872	42.5	.836	42	NW	Fair; clouds.
5	9 a. m.	.950	67.5	.849	67	N.	Fair; clouds.
5	3 p. m.	.840	57	.766	57	NE	Fair; clouds.

a Barometer "No. 2," not used in computation, is again recorded to 9 a. m., September 12, commencing at this date.

Barometric and Meteorological Observations—Continued.

Locality and date.		Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Sept.	5	9 p. m.	28.748	42	28.714	41.5	0	Fair; clouds.
	6	Sunrise	.682	33.5	.669	33	E.	Clear; slight dew.
	6	9 a. m	.870	70	.763	69	NE.	Fair.
	6	3 p. m	.800	78	.673	77	N	Fair.
	6	9 p. m	.608	42.5	.570	43	N	Fair.
	7	Sunrise	.640	32	.631	32	NE.	Fair.
	7	9 a. m	.880	49.5	.826	50	NE.	Clear.
	7	3 p. m	.962	81	.826	80	E	Clear.
	7	9 p. m	.168	48	.418	48	SE	Pleasant; cumuli.
	8	Sunrise	.610	44	.570	44	W.	Cloudy.
	8	9 a. m	.754	75.5	.632	72	W.	Cloudy.
	8	3 p. m	.650	75	.531	75	W.	Cloudy.
	8	9 p. m	.568	44	.528	41	0	Clear.
	9	Sunrise	.550	25	.559	32	N.	Clear; slight dew.
	9	9 a. m	.982	72.5	.870	72	NE.	Fair.
	9	3 p. m	.594	77	.470	76	SE	Clear.
	9	9 p. m	.566	56	.490	56	SE	Fair.
	10	Sunrise	.526	30.5	.521	30	SW.	Clear.
	10	9 a. m	.660	73	.556	68	SW.	Clear.
	10	3 p. m	.626	69.5	.522	69	SW.	Clear.
	10	9 p. m	.540	48	.490	47.5	0	Clear.
	11	Sunrise	.544	43	.507	42	SW.	Clear.
	11	9 a. m	.820	71.5	.708	71	SW.	Clear.
	11	3 p. m	.726	81	.591	79	W	Clear; smoky.
	11	7 p. m	.690	52	.630	51	0	Fair; clouds.
	12	Sunrise	.656	32	.647	32.5	SW.	Fair.
	12	9 a. m	.648	64	.559	63	SW.	Fair.
	12	6 p. m	.288a	55	.221	55	SE	Fair.
	12	9 p. m	.264	45	.222	45.5	SE	Fair.
	13	Sunrise	.224	37.5	.202	38	SW.	Fair; slight dew.
	13	9 a. m	.250	71	.143	69	SE	Fair.
	13	12 m	.210	83	.073	81	SE	Cloudy.
	13	3 p. m	.134	76	.014	75	S.	Cloudy.
	13	6 p. m	.114	64	.025	64	S.	Rainy.
	13	9 p. m	.216	58	.142	58.5	S.	Rain till 7½ p. m.
	14	Sunrise	.140	52.5	.080	52	W	Cloudy; pleasant.
	14	9 a. m	.172	70	.067	67	SW.	Clouds; fair.
	14	12 m	.124	68.5	.024	67	SE	Cloudy.
	14	3 p. m	.050	61	27.967	60	SE	Cloudy.
	14	6 p. m	.014	56	.945	56	E	Cloudy.
	14	9 p. m	.062	53	28.001	54	E	Cloudy.
	15	Sunrise	.020	44	27.981	44	W	Cloudy; rain at 6 a. m.
	15	9 a. m	.002	61	.921	61	NW	Cloudy.
	15	12 m	.072	62.5	.987	62	NW	Cloudy; rain at 12 m.
	15	3 p. m	.020	59	.952	59	NW	Cloudy.
	15	6 p. m	.132	52	28.073	52	NW.	Cloudy; strong wind.
	16	Sunrise	27.886b	49	27.837	49	W.	Cloudy.
	16	9 a. m	28.148	59	28.072	59	W.	Cloudy.
	16	12 m	.131	58	.060	58	N	Cloudy.
	16	3 p. m	.146	58	.072	58	NW	Cloudy; rain at 3½ p. m.
	16	6 p. m	.170	49	.129	49	NW	Clear.
	16	9 p. m	.020	46.5	27.983	46	NW	Clear.
	17	Sunrise	.158	31	28.152	31	N	Clear.
	17	9 a. m	.288	68.5	.186	68.5	NE.	Clouds; fair.
	17	12 m	.312	64	.222	62.5	N	Clouds; fair.
	17	3 p. m	.100	56.5	.030	56.7	N	Clouds; fair.
	17	6 p. m	.018	48	27.969	48	NW	Clouds; fair.
	17	9 p. m	.092	45	28.051	44.5	NW	Clear.
	18	Sunrise	.270	30.5	.265	31	E.	Clear.
	18	9 a. m	.656b	60	.575	61	E.	Clear.
	18	12 m	.646b	71	.537	71	E	Clear.
	18	3 p. m	.656b	69	.552	69	SE	Clear.
	18	6 p. m	.452b	59	.374	59	SE	Clear.
	19	Sunrise	.582b	29.5	.580	29	N	Fair.
	19	9 a. m	.716b	71	.607	—	N.	Fair.
Mean					28.103	51.4		

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a Barometer No. 1 resumed.

b This and the remaining barometric readings at Camp 22 have been rejected, as without doubt erroneous.

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Camp No. 23.							
Sept. 19	6 p. m	27.760	57.5	27.687	57.5	N.	Clear.
20	Sunrise	.714	46	.670	46	N	Clear.
Mean				27.678	51.7		
Camp No. 24.							
Sept. 20	6 p. m	28.576	65	28.483	65	N	Clear.
21	Sunrise	.550	51.5	.492	51.5	W	Clear.
21	8 a. m	.640	67.5	.540	68	SW	Fair.
Mean				28.172	61.5		
Camp No. 25.							
Sept. 21	3 p. m	29.368	86.5	29.217	86	SW	Clear.
21	6 p. m	.300	71	.188	70	SW	Clear.
22	Sunrise	.299	54.5	.239	54	NW	Clouds; fair.
22	9 a. m	.370	73.5	.251	72	NW	Clouds; fair.
22	12 m	.384	87	.228	87	NW	Clouds; fair.
22	3 p. m	.310	87	.154	87	NW	Clouds; fair.
22	6 p. m	.296	80.5	.159	80	NW	Cloudy.
23	Sunrise	.300	84	.155	59	NW	Cloudy.
Mean				29.199	74.5		
Camp No. 26, north branch of Columbia river.							
Sept. 23	6 p. m	29.024	66.5	28.925	66.5	W	Rain at 5½ p.m., with thunder.
24	Sunrise	.074	56	29.003	56	W	Heavy rain till 9 a. m.
Mean				28.964	61.2		
Camp No. 27, north branch of the Columbia.							
Sept. 24	6 p. m	28.360*	64	28.271	64	W	Cloudy.
25	Sunrise	29.228	53.5	29.163	53	NW	Fair.
Camp No. 28, north branch of the Columbia.							
Sept. 25	6 p. m	29.300	70	29.191	70	NW	Clouds; fair.
26	Sunrise	.440	48.5	.387	48.5	W	Fair.
Mean				29.289	59.2		
Camp No. 29, north branch of the Columbia.							
Sept. 26	6 p. m	29.286	65	29.190	65	N	Fair.
27	Sunrise	.268	43.5	.229	43	N	Clear.
Mean				29.209	54		
Camp No. 30, Okinakane river.							
Sept. 27	3 p. m	29.202	72.5	29.088	72	N	Clear.
27	6 p. m	.180	65	.085	65	N	Fair.
27	9 p. m	.106	52	.045	53	N	Clear; aurora borealis.
28	Sunrise	.226	42	.191	41.5	N	Clear; heavy dew.
Mean				29.102	57.9		

* Observations rejected.

Barometric and Meteorological Observations—Continued.

Locality and date.	Hour.	Barometer No. 1.	Attached therm.	Barometer corrected.	Air thermomet'r.	Wind.	Remarks.
Camp No. 31.							
Sept. 28	6 p. m	27.046	52	26.989	52	N	Clear.
28	9 p. m.	.000	42	.967	42	N	Clear.
29	Sunrise	.026	37	27.005	37	NW	Clear.
Mean				26.987	43.7		
Camp No. 32.							
Sept. 29	6 p. m	27.968	41	27.937	41	W	Clear.
30	Sunrise	.880	39	.854	39	W	Clear; heavy dew.
Mean				27.895	40		
Camp No. 33.							
Sept. 30	3 p. m	28.504[a]	—	....	74	SW	Clear.
30	6 p. m	.450	—	....	60	S	Clear.
Oct. 1	Sunrise	27.880	40	27.851	41	S	Clear.
1	12 m	.682	70	.579	68	SE	Clear.
1	3 p. m.	.656	77	28.532	75	SW.	Clear.
1	6 p. m.	.600	58	.524	59	SW.	Clear.
2	Sunrise	.602	40	.573	40	SW.	Fair.
Mean				27.612	56.6		
Camp No. 34, *Barrier river.*							
Oct. 2	6 p. m.	28.960	61	28.876	60	W.	Fair.
2	9 p. m.	.882	51	.824	50	W.	Fair.
3	Sunrise	29.008	45	.965	45	W.	Cloudy.
Mean				28.888	51.7		
Camp No. 35, *north branch of the Columbia.*							
Oct. 3	6 p. m.	29.420	66.5	29.319	66.5	NW.	Clouds; fair.
3	9 p. m.	.366	54.5	.298	54	W.	Clouds; fair.
4	Sunrise.	.380	40	.350	40	N.	Clear.
Mean				29.322	53.5		
Camp No. 36, *Okinakane river.*							
Oct. 4	12 m.	29.398	72	29.286	71	N.	Clear.
4	3 p. m.	.300	77	.273	75	N.	Clear.
4	6 p. m.	.234	58	.156	58	N.	Clouds; fair.
4	9 p. m.	.202	50	.146	50	NW.	Clouds; fair.
5	Sunrise	.164	41	.131	41	SW.	Cloudy.
Mean				29.198	59.0		
Camp No. 37, *Okinakane river.*							
Oct. 5	Sunset	29.104	66	29.006	66	SW.	Cloudy.
6	Sunrise.	.278	41	.245	41	NE	Clouds.
Mean				29.125	53.5		
Camp No. 38, *Okinakane river.*							
Oct. 6	Sunset.	29.182	62	29.095	61	S.	Cloudy.
6	9 p. m.	.174	49.5	.119	49	S.	Cloudy.
7	Sunrise	.195	45	.152	45	NW.	Cloudy.
Mean				29.122	51.7		

[a] Aneroid No. 7992 not computed.

NOTE.—The barometric observations for the remainder of the route are of the aneroids, and have no value in determinations of altitudes. The temperature observations are continued, in a different arrangement, as far as Fort Colville, with some references to the readings of the aneroid barometer.

Meteorological Observations on route to Fort Colville.

Date.	Locality.	Thermometer.						Weather.
		Sunrise.	9 a. m.	12 m.	3 p. m.	Sunset.	9 p. m.	
Oct. 7	Camp 39, Okinakane river.					56		Clear; wind N.
8	Camp 39, Okinakane river.	32						Clear; wind N.
8	Camp 40.					52		Cloudy.
9	Camp 40.	46						Cloudy.
9	En route.		53	68	59			Cloudy.
9	Camp 41.					64		Cloudy.
10	Camp 41.	54	56.5	60	61	54		Cloudy.
11	Camp 41.	53.5	58.5	59	57			Cloudy; rain at 3 p. m.; strong SE. wind.
11	Camp 42.					54		Cloudy.
12	Camp 42.	45	49.5					Pleasant.
12	En route.			54	49			Clouds; S. wind.
12	Camp 43.					46		Fair.
13	Camp 43*	38						Cloudy; E. wind.
13	En route.		49.5	56				Fair.
13	Camp 44.					43	36	Clouds; wind W. & NW.
14	Camp 41.	38	42					Rain; E. wind.
14	En route.			58.5	50			Rainy until 11 a. m.
14	Camp 45.					48	46.5	Cloudy.
15	Camp 45.	45	50.5					Clouds and rain.
15	En route			54				Cloudy.
15	Camp 46.					53		Fair.
16	Camp 46.	49	50					Cloudy; E. wind.
16	En route.			58	54			Clear.
16	Camp 47.					54		Cloudy.
17	Camp 47.	39	41					Cloudy; W. wind.
17	En route.			50.2				Cloudy.
17	Camp 48.					48.5	40	Cloudy.
18	Camp 48.	38.5	42	59				Clouds; W. wind.
18	Camp 49, (Fort Colville.)				56.2	53		Clouds; pleasant.
19	Camp 49.	30	44	63.5	58	42		Fair; pleasant; cloudy.
20	Camp 49.	28	42	58	55	47	40	Misty; cloudy.
21	Camp 49.	35	42	59	52	43		Cloudy day.
22	Camp 49 and en route.	21	24.5	48	40			Clear.
22	Camp 50.					32.5	23	Clouds.
23	Camp 50 and en route.	10	28	51	44.5			Few clouds.
23	Camp 51.					43	35	Cloudy; frost.
24	Camp 51 and en route.	30	32.5	34.5	34.5			Snow 6 inches; wind NW.
24	Camp 52.					33	32	Cloudy; wind SE.
25	Camp 52 and en route.	31.5	32	34				Clouds and mist; E.
25	Camp 53.					35	33	Clouds and mist; S.
26	Camp 53 and en route.	32	36	41	38			Clouds; E. wind.
26	Camp 54.					37	36	Few clouds, NE. wind.
27	Camp 54.	30.5	36	45	50	37		Cloudy; fair; calm.
28	Camp 54.	29.5	35	50	50	41	35.5	Fair; cloudy; NE. wind.
29	Camp 54.	37	51	60	57	54	52	Cloudy; SE. wind; SW. at evening.
30	Camp 54.	52.5						Cloudy; rain; strong SW. wind.
30	Camp 55.				61	52.5		Cloudy; strong SW. wind.
31	Camp 55.	25	40	45.5	42	40		Clouds; fair; wind SW.
Nov. 1	Camp 55.	27						Cloudy.
1	Camp 56†					32	19	Clear.

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* On a branch of the Columbia, east of Okinakane river.

† On the plains south of Spokane river, and on the tributaries of Snake river, or Lewis's Fork.

NOTE.—The remaining observations are in the valley of the Columbia, and on the plain, and present no noticeable feature.

List of Altitudes of the line from Columbia Barracks to Fort Okinakane.

Camp.	Barometer.	Thermometer.	Altitude.
		°	*Feet.*
1	29.828	74.6	157.2
2	29.706	79.3	276.7
3	29.728	78.6	255.5
4	29.410	72.0	553.5
5	29.251	68.5	702.7
6	29.535	59.3	430.0
7	29.549	59.7	417.0
8	29.680	56.9	312.8
9	29.337	60.0	615.4
10	29.167	58.7	782.5
11	27.053	57.7	2840.1
12	26.834	53.3	3049.0
13	25.968	48.0	3923.7
14	27.747	53.0	2430.8
15	27.930	66.0	1980.3
16	28.122	65.0	1789.1
17	27.222	55.4	2662.5
18	27.725	58.7	2168.7
19	28.594	63.8	1331.4
20	27.968	55.3	1921.7
21	28.131	63.5	1777.6
22	28.103	51.4	1782.3
23	27.678	51.7	2198.6
24	28.172	61.5	1732.4
25	29.199	74.5	756.5
26	28.964	61.2	968.7
27	29.163	53.0	781.6
28	29.289	59.2	754.1
29	29.209	54.0	738.8
30	29.102	57.9	834.7
31	26.987	43.7	2804.5
32	27.895	40.0	1960.4
33	27.612	56.6	2275.6
34	28.888	51.7	1048.8
35	29.322	53.5	624.3
36	29.198	59.0	745.2
37	29.125	53.5	808.5
38	29.122	51.7	811.1

ERRATA.

In table of latitudes and longitudes, page 456, for latitude of Fort Colville, 46° 36′ 16″, read 48° 36′ 16″.

In table on page 568, for mean difference of readings of wet and dry thermometers, August, 1854, for 15°.7, read 16°.7.

RISE AND FALL OF THE COLUMBIA RIVER AT FORT VANCOUVER.

WASHINGTON, D. C., *November* 7, 1854.

SIR: I enclose herewith a letter from Mr. John D. Biles to Mr. Gibbs, explanatory of an accompanying table of the rise and fall of the Columbia river at Fort Vancouver during the "spring rise." Mr. Biles was of my party in that country last year, and I know that perfect reliance may be placed upon his results.

As the information is of value in more than one regard, I would request that it may, if possible, accompany my reports.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieutenant Engineers and Brevet Captain.

Capt. A. A. HUMPHREYS,
In Charge of Pacific Railway Office.

COAST SURVEY STATION, NEAR CAMDEN, MAINE,
November 1, 1854.

DEAR SIR: In a letter from George Gibbs, Esq., dated at Steilacoom, he sends observations on the freshets observed at Fort Vancouver by Mr. John D. Biles, and intimates that they may be useful to you. I send, therefore, a copy of the tables, and of Mr. Biles's letter.

Yours, respectfully,

A. D. BACHE.

Capt. McCLELLAN,
Corps of Engineers.

WASHINGTON TERRITORY, COLUMBIA CITY,
August 20, 1854.

DEAR SIR: Enclosed I send you the observations of the Columbia river during the freshet commencing May 8, 1854, and ending July 20. I also observed the temperature of the air and water at the same time. The observations of the river were measured by a common two-foot rule. I presume you will easily understand the register. The figures in the column headed "rise," show the amount of water each twenty-four hours; that is to say, May 8th the river rose two inches, May 9th two and a half inches more, and so on, as registered. The figures under the column headed "fall," the same way.

You will also observe, by the register, that on the 7th day of June the river commenced to fall, continued till June 16, and during that time fell three feet one and five-eighths inches. The water was not so high this year, by four feet, as last year, and the year before. The convexity of the river, at its highest, was, as near as I could judge, ten inches, and during its fall, about eight inches. The velocity in the channel at low water is one hundred yards in two minutes and twenty-two seconds; at high water, one hundred yards in one minute and thirty-eight seconds.

It was impossible to measure the deposit, as it was such a small quantity, in four gallons of water. I have preserved every particle, and enclose each observation in a separate paper. The one marked May 31, was taken when the river was rising; the paper marked June 30, when the water was at its highest; and the one marked July 20, in its general stage. I also take one to-day, August 20. I could not procure scales accurate enough to weigh them, thinking you could weigh them after you receive them. Each package contains the amount of deposit of four gallons of water. If there is any part of the observations you cannot make out clearly, inform me, and I will give you all the information I possibly can, with pleasure. I shall comply with your request to take the amount of deposit every month; and if circumstances permit, shall take observations of the river during the winter freshet, and also next spring.

Yours truly,

JOHN D. BILES.

GEORGE GIBBS, Esq.

Observations of Columbia river during the freshet commencing May 8, *and ending July* 20, 1854; *by John D. Biles, Fort Vancouver, Washington Territory.*

Hour.	Date.		Rise.	Fall.	Temperature of air.	Temperature of water.	Remarks.
			Inches.	*Inches.*	°	°	
8 A. M.	May	8	2	....	41.5	40	Water very muddy.
"		9	2¼	....	42	41.2	Do.
"		10	3½	....	42.5	41	Do.
"		11	4⅜	....	43	42.5	Do.
"		12	4	....	42.5	41.2	Water clearer.
"		13	3½	....	42.9	41.5	
"		14	4½	....	44	43.1	
"		15	5¼	....	45.5	44	
"		16	4⅞	....	46.5	44.5	
"		17	4⅜	....	46	43.75	
"		18	4½	....	45.5	44	
"		19	5	....	48	46.5	
"		20	4½	....	48.5	46.2	Water muddy.
"		21	5⅜	....	47.5	44.75	Do.
"		22	4	....	48	46.75	Do.
"		23	3⅜	....	47.5	45.75	Do.
"		24	3	....	47	44.5	Do.
"		25	2½	....	47.5	45	Do.
"		26	2	....	46.5	45	Do.
"		27	2½	....	47	45.5	Do.
"		28	2¼	....	49	46	Water clearing.
"		29	2⅜	....	49.5	46.5	Do.
"		30	3	....	50	47.5	Water clearer.
"		31	3¼	....	50.75	48	Do.
"	June	1	3½	....	51.5	49.2	Water very muddy.
"		2	2	....	50.5	49	Do.
"		3	½	....	50	48.5	Do.
"		4	¼	....	49.5	48	Do.
"		5	....	....	49	48.5	River at a stand.
"		6	....	....	49.75	47.75	Do.
"		7	....	1	48.5	46	Commencement of fall.
"		8	....	3½	47.5	45.75	Clearing.
"		9	....	4⅜	48	46	
"		10	....	3⅞	47.5	46.5	
"		11	....	5	46.5	47.75	
"		12	....	6½	46	45.5	
"		13	....	5¼	47.1	46	
"		14	....	3½	48.5	47.75	
"		15	....	1	49	48.3	
"		16	....	....	50.5	49	River at a stand.
"		17	....	....	51.5	50.5	Do.
"		18	....	½	51	49.75	Fall.
"		19	....	....	52	50.5	River at a stand.
"		20	½	....	52.5	51.75	Commence to rise.
"		21	1⅜	....	52	50.5	
"		22	2½	....	49.9	48.5	
"		23	4⅛	....	51.5	50	
"		24	5⅜	....	53.1	51	
"		25	6	....	55	53.1	
"		26	5⅜	....	56	53.5	
"		27	7⅛	....	55.5	54	
"		28	10	....	59	54.5	
"		29	11½	....	58.75	54.9	
"		30	12½	....	57.5	55	
"	July	1	1½	....	51	47.75	Water clear.
"		2	½	....	52.5	48	
"		3	....	....	52.75	48.5	Stand.

Observations of the Columbia river, &c.—Continued.

Hour.	Date.	Rise.	Fall.	Temperature of air.	Temperature of water.	Remarks.
		Inches.	*Inches.*	°	°	
8 A. M....	July 4	....	....	53	48. 75	Stand.
"	5	....	½	53. 75	48. 5	Fall.
"	6	....	3	54. 5	49	Water continues clear during fall.
"	7	....	5¼	55	49. 75	
"	8	....	7¾	55. 5	49. 9	
"	9	....	10½	55	50. 5	
"	10	....	13¼	55. 9	50. 9	
"	11	....	15	56. 75	51. 5	
"	12	....	14½	56	51. 75	
"	13	....	16¼	54. 75	51. 5	
"	14	....	13½	55	51. 2	
"	15	....	18	55. 75	52	
"	16	....	16¾	56. 5	52. 5	
"	17	....	14½	56	52. 1	
"	18	....	12¼	56. 75	52. 2	
"	19	....	6	57. 5	53	
"	20	....	2½	58	53. 5	River about the usual stage.
	Total......	159⅜	207¼			
	Highest....	121⅜ above spring level.				
	Highest....	207¼ above summer level.				

CORRESPONDENCE.

OLYMPIA, WASHINGTON TERRITORY,
December 12, 1853.

DEAR SIR: I find it of great consequence to the survey to make certain examinations of the passes in the Cascade range during the winter—examinations really indispensable to a reliable preliminary report the present session of Congress.

If you and your party are not altogether too much exhausted by your protracted labors, I wish you to take an important part in these examinations.

There are two passes in the Cascade range, about fifteen and thirty-five miles, respectively, north of Mount Rainier. The first pass, called the Nahchess Pass, follows along the Nahchess tributary of the Yakima river, and was pursued by the emigrants the present year. The second or northern pass, called the Snoqualme Pass, is along the main Yakima river, and up a broad open valley, and the dividing ridge is only three thousand five hundred feet above the sea. The Nahchess Pass is five thousand feet above the sea. The climate in the Puget Sound district is of extraordinary mildness, and modifies greatly the climate of the Cascade passes. The Snoqualme Pass, I am perfectly satisfied from the information I have received, is practicable for pack-horses every month of the year, excepting that in very severe winters it may be impassable in February.

I have therefore to direct that, on your arrival at Wallah-Wallah, you fit yourself out to continue your work to this point over the Cascade mountains by the Snoqualme Pass, and will, for this duty, purchase fresh and sound animals, furnish yourself with at least thirty days' provisions, secure a good, reliable Indian guide, and start with the determination to push yourself through.

I have left in charge of Mr. Pambrun, the gentleman in charge at Wallah-Wallah, some forty-five animals; but it is doubtful whether any of them will be equal to the work. By conference with him, with Bomford and Brook, who live at Whitman's mission, and Pu-pu-mux-mux, the Wallah-Wallah chief, you will be able to secure good animals. Do not take one in trust, however. Have each one thoroughly tested, and be particular in the price. Take some days to fit yourself out in the most complete manner. You will need some axes and a good supply of matches.

On the route you must be on your guard not to be misled by wrong information. It is believed here that the priests at the Yakima mission, on the line of your route, are in the habit of representing the country and the climate in the worst possible light, in order to discourage settlements; and the Indians, you well know, are prone to story-telling.

So far from finding the route exceedingly difficult, I am satisfied it will be your quickest and easiest way of reaching this point.

On the 8th of November certain Indians came into Wallah-Wallah with the report that the emigrants were obliged to abandon their wagons and animals in consequence of snow in the Nahchess Pass, and that the week previous two Indians turned back, the snow being up to the breasts of their horses; whereas the emigrants saw no snow whatever in the pass, and none fell till the 3d of November, and that to the depth of only four inches. The day they brought in that report, and for a fortnight later, it is not probable there was even one foot of snow at any point of the route.

The Yakima Indians on your route are civil and obliging, and their chiefs, Tias, Caroni-ach, Ska-loo, and Oubac, are very friendly. Pu-pu-mux-mux will, I think, be of great assistance to you, and will accompany you, I have no doubt, a part of the way. His influence over the Indians is very great, and he will be able to secure good guides, and keep down false reports. Say to him I earnestly desire him to accompany you. He has many beef-cattle. It would be well to have driven one or two with your party, to the farthest point they can reach; then kill them, pack what you can, and *cache* the rest; you have something to eat in case of a reverse. Indians should be got to drive them. You ought to have one or two Indians for herders. Whilst I am confident you will go through without difficulty, I wish every precaution taken to guard against reverses, so that no suffering shall be experienced by yourself or any member of your party. You ought to have snow-shoes.

You will, however, proceed with extreme caution and make arrangements at the last Indian village for a depot of provisions, to fall back upon in case of a sudden fall of snow, compelling you to pause for some days; or in case you be satisfied that the route is impassable, and that, contrary to my confident belief and expectation, it is absolutely necessary that you return to Wallah-Wallah. Even this fact will be of great consequence, and will show there are greater difficulties to be encountered than we now look forward to. Provisions you will be able to get of Mr. Pambrun; but it may be you can do better as to procuring beef with Bomford and Brook, or with Pu-pu-mux-mux. I should prefer that you get all you can of Pu-pu-mux-mux.

On your route you will make your examinations with your usual care, noting everything of importance pertaining both to rail and wagon roads; and if your barometer is not broken, continuing your barometric profile. In the postscript to this letter I will give the principal facts as regards the western slope of the Cascades, and add a sketch.

The route from Wallah-Wallah to this point by the Columbia and the Cowlitz rivers is a long and somewhat disagreeable one. Provisions and animals are to be got at Wallah-Wallah, the Dalles, and Vancouver. Our animals at Wallah-Wallah are in charge of Mr. Pambrun; at the Dalles are in charge of Sergeant Martin, and at Vancouver of Mr. Swissler, an old resident well known there. The road is very good to the Dalles, but somewhat difficult thence, though practicable to Vancouver. Thence there is a practicable trail to this place, some little forage being, however, required, in consequence of a deficiency of grass. Instead, however, of going all the way by land, you can go down the Columbia river to a little village just above the mouth, and on the west bank of the Cowlitz river, called Monticello; whence, taking a light Indian canoe, (a barge or bateau should not be used at this season of the year,) you go up the Cowlitz about thirty-two miles to Cowlitz landing. Thence there is a good road to this place, the distance being about sixty miles. From Vancouver to Monticello the distance is forty-five to forty-eight miles. Should you be compelled to come this way, go to the Dalles by land, provided you are not compelled to purchase animals; thence to Vancouver by the Columbia river, (you can probably get through for about seven dollars per man,) and to this point by land; unless, again, you are obliged to purchase animals. I send herewith a note directing Mr. Pambrun, Sergeant Martin, and Mr. Swissler to deliver up such animals as you may select, or to receive from you such as you may deliver up, giving you receipts therefor. You should have a descriptive list of each animal, and they should, if practicable, be branded. On the two trails from Wallah-Wallah to the Dalles, and from Columbia barracks to this point, the animals should be in good order at this season of the year; packs should not be more than one hundred pounds, and at least half a bushel of oats, barley, or corn, should be taken along for each animal.

Very truly, yours, ISAAC I. STEVENS.

A. W. TINKHAM, Esq., *Fort Wallah-Wallah.*

N. B.—The enclosed sketch will show how the trail from the pass connects with Snahomish river and Port Gardner, with the White River valley, and Elliott's bay. Alki and Seattle are two flourishing settlements. It is probable the line of railroad will run either to Port Gardner or to some point north, as Bellingham bay. I will have established at the falls a depot of provisions and two or three men, and I shall send up a party into the pass from this side, which will probably meet you. They may run the line to Bellingham bay. Make the falls a point in your route. Should your animals be exhausted and unfit for further service, send them by one or two men to Steilacoom, and take canoes and go down the river. It is about one day down the river to its mouth, and a day and a half to Olympia. If your animals are strong enough, come through all the way by land. I want you to see how railroads and wagon roads can be brought down from the pass to Steilacoom, including, if practicable, a line to Elliott's bay. This line is said to be impracticable. I will send forage to the falls. Write me word of your departure from Wallah-Wallah, and take pains to have it forwarded promptly.

OFFICE NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Olympia, Washington Territory, December 30, 1853.

SIR: I have the honor to report the arrival of Lieutenant Arnold, from his route by the northern trail to Colville, and thence by the line of the Columbia river to Wallah-Wallah, and acknowledge his energy and promptitude in making, at this late state of the season, valuable contributions to our knowledge of the country passed over by him.

Lieutenant Arnold, under instructions from Lieutenant Donelson, left his camp at the crossing of Clark's fork, west of the Pend d'Oreille lake, on the 24th of October, with a select party of six men, an Indian guide, and eighteen animals, and reached Colville on the 30th. Here, in pursuance of instructions left by me, he ascended the Columbia in canoes and found the mouth of Clark's fork about two miles north of the 49th parallel, and thus settled a disputed question of geography. His route from Colville to Wallah-Wallah was by the Grand Coulée. The following extracts from his reports to me, of this date, will give a general view of his route.

"In accordance with your instructions, I ascended the Columbia to the 49th parallel, which was found to cross the Columbia about two miles south of its confluence with Clark's fork. My observations in connexion with the survey of this portion of the river were confined to a narrow belt of country, included between two parallel ridges of mountains, whose general directions were north and south. This belt was level, gradually ascending to the north, well wooded, and, even at this late season, covered with fine grass; the soil alluvial and sandy. The mountain ranges are a continuation of those seen along the western bank to the south, to the east presenting one uniform unbroken outline, the first pass being at Colville; the current of the river rapid in the channel, with innumerable eddies and whirlpools along its banks; its bed rocky. Having completed the survey of the Columbia north of Colville, I left the latter place on the 14th of November and marched along the east bank of the Columbia for six days—distance, about 110 miles; the trail over a level and wooded country, to the Spokane river, and from the latter place to where the Columbia makes the great bend to the west, and from here to the mouth of the Grand Coulée, exceedingly rough and dangerous; the country to the east and south, after leaving the high banks of the river, undulating. At this point, 110 miles from Colville, I proceeded south from the river, and immediately made an ascent of about 100 feet, when I came to the Grand Coulée. This mighty avenue, about 15 miles to the south, and three to six in width, has a gradual ascent to the south. Its sides are one perpendicular mass of molten rock, about 800 feet in height, and on a level with the grand plain of the Spokane. With the exception of a few trees, seen in this coulée, there is no timber between this coulée and the Columbia. After marching 30 miles, I entered the most southern and second coulée in size. Its general appearance was like the former, and it was about six miles in length, with a more westerly direction. The country between these coulées generally level, with the exception of innumerable smaller ones, like those already mentioned. From the southernmost coulée to the Columbia the country is level and sandy. In short, the section of country included between the Columbia to the north and west, the headwaters of the Peluse and Spokane to the east, and Snake river to the south, is one grand plain; which, near the Columbia, is divided into innumerable chasms, called coulées, running in all directions, and owing their origin to one general cause. From this point to the Columbia the country is one grand level, gradually descending to the south. My trail struck the Columbia about 10 miles north of the Yakima. The distance from the great bend of the Columbia to the west, to the latter point, is about 130 miles. The country from this point to the Columbia is level, my route being along the east bank, crossing Snake river about a quarter of a mile from its mouth; distance 34 miles. The distances given above are mere approximations, which will be corrected when the data is completed."

Captain McClellan, on the 28th instant, left Steilacoom with a small party in canoes to explore the shores of the sound, with reference to the railroad depot, and to ascend the Snohomish river and its tributary, the Snoqualme river, to the Snoqualme falls. From this point, with Indian horses procured in the neighborhood, he will go to the Snoqualme Pass; or, if the snow renders the route impracticable, on snow-shoes, and thence take the railroad down to the sound. Previous to his return to this point he will endeavor to make an examination of the work done on the military road.

I am, sir, very respectfully, your obedient servant.

ISAAC I. STEVENS,
Governor of Washington Territory.

HON. JEFFERSON DAVIS,
Secretary of War, Washington City.

OFFICE NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Olympia, Washington Territory, January 31, 1854.

SIR: I have the honor to report that, as announced to you in my letter dated December 19, Captain McClellan left Olympia on the 23d December in a canoe, arriving at Steilacoom that evening. He received verbal instructions to carry down the lines from the Snoqualme Pass to the several good harbors of the sound, going as far northward as Bellingham bay, and to examine the several ports of the same to determine the proper terminus of the railroad. The duty of collecting information as to a wagon road along the shores of the sound from Steilacoom to Bellingham bay, was also assigned to him. Unable to procure horses or guides at Steilacoom, he determined to take canoes to go by the Sinahomish and Snoqualme rivers to the Snoqualme falls, and thence to ascend to the Snoqualme Pass on foot. It was unfortunate that about this time very severe weather set in, the thermometer ranging much lower than at any time last winter, which was one of unusual severity. In consequence of this, and finding considerable snow upon the ground, increasing rapidly as they continued on, Captain McClellan, with his party, after going seven miles beyond the falls, deemed it imprudent to go farther, and thence returned. Captain McClellan was able, however, to add much to our previous knowledge of the country, and we know from his examinations that the route is somewhat more difficult than has been previously reported. A railroad line can still be brought down, with grades approaching the pass from the east not exceeding fifteen or twenty feet to the mile, and with grades descending to the sound not exceeding sixty feet to the mile, but at the cost of an expensive tunnel. Captain McClellan has prepared a brief report of his operations, written hastily as merely a memorandum, which is extremely interesting. The enclosed is a copy of the same.

Further examinations are still requisite before a comparison can be made between this line and that of the Columbia and Cowlitz rivers.

While Captain McClellan was making these examinations, I took a trip by sailing-vessel down the sound, continuing as far as Vancouver's island, my object being to take a census of the Indian tribes in that vicinity, and to acquaint myself with the harbors of the sound with reference to the termination of the railroad line. I was agreeably impressed with Elliott's bay, on which are the flourishing towns of Seattle and Alki, and I agree entirely with Captain McClellan, in the opinion that it is the best harbor of the sound, and unless the approach to it from the pass should, on a more minute examination, prove less favorable than to some other point, and which is hardly to be expected, that it is the proper terminus of the railroad. During my stay at Seattle, two sailing-vessels arrived directly from San Francisco, only six days from that port. A more complete report will be forwarded as soon as the proper data can be obtained.

I have now the honor to report that an express messenger reached this place this morning, bearing despatches from Mr. Tinkham, dated Wallah-Wallah, January 2, 1854, stating that, in accordance with my instructions, he had fitted out his party for the crossing of the Cascade mountains to this point, through the Snoqualme Pass. He was to leave on the 3d of January, and has consequently been out twenty-eight days, and may daily be expected to reach us. Mr. Tinkham had had an adventurous trip since our separation in the St. Mary's valley. Leaving us at that point, he crossed the rocky mountains through the Marias Pass, between October 7th and 28th. He found that this line involved a tunnel of two miles, and high grades for a railroad, and for a wagon road he deems it impracticable. He encountered no snow of consequence, and after a short stay at Fort Benton, where he found everything pertaining to the post established at that point in charge of James Doty, Esq., in excellent condition, he recrossed the mountains for the third time within six weeks, taking a new trail, intermediate between the Hell Gate and Blackfoot passes, the ones taken respectively by Lieutenant Mullan and the main train. This pass he found entirely practicable for wagons even at this moment. The dividing ridge is a mere hill, its summit but six thousand feet (6,000) above the level of the sea, and so easy of ascent that in ascending to the summit they were enabled to keep a trot, though the road was slippery in consequence of a large camp of Pend d'Oreille Indians having preceded them. A portion of this band they passed in the ascent, and afterwards accompanied them through the entire pass. They were returning from the buffalo hunt, and heavily laden with meat. A copy of Mr. Tinkham's report, which was written rather hastily at Wallah-Wallah, is herewith enclosed; and I beg leave to call your attention to the extraordinary energy he has shown, not only in his crossings of the Rocky mountains, but when, on the southern Nez Perces trail between St. Mary's and Wallah-Wallah, he afterwards encountered deep snows, which compelled him to send his animals back to St. Mary's and to travel on snow-shoes, each man with a pack of from fifty to seventy pounds on his back. They thus made the entire crossing of the Bitter Root mountains in fifteen days, and then, issuing out upon the prairies, they found but little snow, and at the house of an American settler which lay in their route they were enabled to procure horses, with which they proceeded to Wallah-Wallah. On his arrival here, which, as I have before mentioned, is anticipated at any moment, he will have completed a most hazardous and adventurous trip, deserving of the highest praise. At Wallah-Wallah Mr. Tinkham found my instructions to pursue the route through the Snoqualme Pass, and a copy of these instructions are enclosed herewith.

Mr. Tinkham brought a report from Mr. Doty, who was entering finely upon the field before him. Lieutenant Grover had not returned from his survey of the Missouri between the falls of the Missouri and Fort Union. From Mr. Tinkham's good success in getting through the snow in the Bitter Root mountains, I am relieved of all apprehension I might have entertained as to the success of Lieutenant Grover, who will set out fully equipped for his adventurous journey.

Mr. Tinkham also brought reports from Lieutenant Mullan, and a copy of a report of a reconnaissance made by him to the headwaters of the Jefferson's fork of the Missouri is herewith enclosed. At the time of Mr. Tinkham's leaving the valley, he had established a winter camp, fourteen miles from Fort Owen, up the St. Mary's valley, and he was employing his men in the erection of four log-houses, the expense of which will not exceed twenty-five dollars for all. If the operations are resumed next season, these houses will serve for the depot of provisions, or otherwise will be available as the quarters of the Indian agent to be appointed in that valley.

Lieutenant Mullan reports that the Blackfeet Indians are keeping their promises of peace but faithlessly; and I would respectfully suggest, that I have strongly recommended to the Indian Department an appropriation for a general Indian council at Fort Benton during the coming season, and that I have set forth the necessity of a military force being present. I would strongly recommend to the War Department the establishment of a military post at or near Fort Benton for the protection of emigrants, to whom, I think, a route is now opened which will compete favorably with that through the South Pass. Ascending the Missouri river with their effects, which has been found to be navigable for steamers to the mouth of Milk river, and will, I believe, be found navigable to the falls of the Missouri by Lieutenant Grover's survey, and having their cattle driven along the trails by the river-bank, they will from Fort Benton, and even from the mouth of Milk river, find fair wagon roads to the St. Mary's valley. By the mail which takes this communication I shall forward a report upon wagon roads, from which it will be seen that but little labor is required to open a tolerably good road through to Wallah-Wallah.

Very respectfully, sir, your most obedient servant,

ISAAC I. STEVENS,
Governor of Washington Territory, in Command of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington.

P. S.—Within six hours of writing the above, Mr. Tinkham reached Olympia from the Snoqualme Pass, and bringing information of the most important character; the snow deposited in layers of one or two feet, but six or seven feet deep for some six miles, and one and a half foot or more for only about forty-five additional miles, and undisturbed by wind, and offering not the slightest obstruction to the passage of trains. The grades good to Seattle, with a tunnel of considerable length. I herewith enclose a copy of Mr. Tinkham's report, and cannot too much commend the energy and judgment which he has shown in crossing, in mid-winter, the Cascade range, and actually bringing to the sound the route of the Snoqualme Pass, and thus accomplishing what had not been done by the previous labors of the expedition.

OLYMPIA, W. T., *January* 31, 1854.

SIR: In compliance with your instructions of this date, I have the honor to submit the following memoranda of my late trip to the vicinity of the Snoqualme falls.

December 23.—Left Olympia in a canoe, manned by three Indians, for Steilacoom. The party consisted of Mr. J. F. Minter, Mr. Bigsby, and three men—Roche, Nicholls, and Lisette. Reached Steilacoom shortly after dark. As my original intention was to take horses at Steilacoom for the Snoqualme falls, and thence proceed as far as practicable on snow-shoes, in the mean time sending a canoe to meet me with provisions at the falls, I spent five days at Steilacoom in endeavoring to procure animals and guides. The few Indians who knew the trail were not to be induced to go—representing that the streams could not be crossed, &c., &c. I also found that still further delay would be necessary to procure the requisite animals, and that there was no certainty of their being ultimately procured. I therefore changed my plan, and determined to go by water to the falls, and proceed as far as possible on foot.

On the 29th I left Steilacoom, late in the afternoon, with two canoes, reaching the mouth of the Sinahomish late on the first of January. This river empties into Port Gardner, directly opposite Gedney island. At its mouth are extensive sand-flats, quite thickly covered with large trees that have probably been swept down the river in high water. The harbor between the flats and Point Elliot, although a very fair one, is by no means suitable for the terminus of a great railroad.

Being greatly retarded by high water, we did not reach the vicinity of the falls until January 7, where we encamped about three-quarters of a mile below the falls, having occupied six days in making a distance of some fifty-two miles.

Thus far the weather had been intensely cold, but on the 7th it moderated somewhat; and on the morning of the 8th I started on foot with Messrs. Minter and Bigsby, and Lisette, to reach a prairie said to be above the falls, and endeavor to verify, by actual observation, the Indian statements as to the depth of the snow, &c.

The trail passed for about three miles on the north side of the river, was very hilly and much obstructed by brushwood and snow. We then crossed the river in a small canoe, and found ourselves at the edge of the prairie; walking on about two miles, we reached the bivouac of the Indian horse guard. Before arriving at the falls, I had met quite a number of Snoqualme Indians (among them the chief, Pat Canem,) and some Yakimas, spending the winter on this side of the mountains. I uniformly made inquiries of them in relation to the mountains, snow, &c., and endeavored to procure guides. One Yakima gave a reluctant consent to accompany me as far towards the pass as it was possible to go, but the next morning he flatly refused to go, saying that he would surely lose his life in the attempt. The statement of all these Indians, given at different times and places, was uniformly the same, and to this effect:

That on the prairie we could find little or no snow; that as we left the prairie we could find the snow gradually increase in depth until, at the falls of the Nooksai-Nooksai, (at the head of which valley is the pass improperly called the Snoqualme Pass,) it would be about to the armpits, and thence towards the summit gradually increase to the depth of some 25 feet; in addition, that it is so light and dry as to make the use of snow-shoes impracticable; but that at the expiration of "two moons and a half" (about the end of March,) the snow would pack down and harden so that either horses or snow-shoes might be used.

I found the prairie to be about as represented—in places bare, but in others with three or four inches of snow. Leaving my companions at the Indian bivouac to make the best preparations they could for passing the night, (for we had neither tent, blanket, nor overcoat,) I went forward on the trail with two Indians.

As soon as we left the prairie the ground became entirely covered with snow; it soon became a foot deep in the shallowest spots, and was constantly increasing. All signs of a trail were obliterated—the underbrush very thick and loaded with snow—the snow unfit for snow-shoes, according to the Indians. I now turned back to our bivouac, and there awaited the arrival of an Indian who was out hunting, and who was said to possess much information about the country.

He soon arrived, and proved to be a very intelligent Yakima, whom I had seen on the other side of the mountains in the summer. He had been hunting in the direction I wished to go, and stated that the snow soon increased to "waist-deep" long before reaching the Nooksai-Nooksai, and that it was positively impracticable to use snow-shoes. He also said that the Indians did not pretend to cross the mountains at this season, but waited until about the end of March, and then took their horses over.

Next morning, after again questioning this Indian, I reluctantly determined to return, being forced to the conclusion, that if the attempt to reach the pass were not really impracticable, it was at least inexpedient under all the circumstances in which I was placed. On the 10th I started down the river, and on the evening of the 11th camped near the mouth. The prairie above the falls is about two and a half miles in length, by some three-quarters of a mile in width. The soil is of black loam and is very rich; in summer it is covered with grass and fern. There were about eighteen Yakima horses there at the time of our visit, all in very poor condition; several died this winter, and probably more will meet the same fate before spring. I estimated the height of the falls to be 130 to 150 feet high; they are very beautiful.

The Sinahomish forks about eighteen miles from its mouth; the north fork is called the Skywhamish, and the south fork the Snoqualme. The general course from the mouth of the Sinahomish to the falls of the Snoqualme is S. 17° E. There are also falls on the Skywhamish, the Nooksai-Nooksai, (that branch of the D'Wamish which heads in the pass,) the Steilaghaumish, the Seatchel, &c. Above the falls of the Nooksai-Nooksai is a large lake.

With the exception of one small prairie, (now cultivated by the Indians,) about ten miles below the falls, the bottom of the Sinahomish and Snoqualme is very indifferent, generally consisting of pure sand, covered with one or two inches of soil. The section of the bluffs is of sand, clay and gravel, occasionally argillaceous rock, stratified and unstratified. The timber is generally poor—a great deal of cotton-wood, indifferent cedar, and fir; maple and alder are also met with. In some places there are small tracts of good fir and cedar.

There is said to be some good land on the Skywhamish a few miles above its junction with the Snoqualme. The Skywhamish is rather the larger of the two. Near the mouth of the Sinahomish are extensive cranberry swamps. The bottoms are usually wide, flat, and subject to overflow; occasionally, ridges border the stream. There is a foot-trail from a point on the Snoqualme, about eight miles below the falls, to the large lake behind Seattle; one day from the Snoqualme to the lake—one more to Seattle, in a canoe.

If there is any coal in the valley of the Sinahomish it will be found some little distance back, in a bluff about twelve miles above the mouth. The river would be easily navigable for small steamers to this point, in low water.

From the mouth of the Sinahomish I went, via Port Susan and the canoe channel, to the head (north extremity) of Macdonough's island, intending to proceed to Bellingham bay. We encamped on the island the night of the 12th.

During that night six inches of snow fell, and a violent gale arose, so that on the next day we were unable to proceed. On the next day, (14th,) the wind still continuing dead ahead, and very violent, I turned back, taking the Saratoga passage, and encamped that night on Gedney island, where there is an excellent spring.

On the 15th camped on the small lake which connects with the salt water, about five miles to the north of Seattle.

On the 16th reached Seattle; the floating ice gave us much trouble. On the morning of the 17th abandoned the idea of going up the D'Wamish, the ice being so thick and abundant as to close the passage.

Reached Steilacoom, in a heavy gale, on the 18th.

The result of my examination as to harbors is, that of all the harbors between the north end of Whidby's island and Olympia, that of Seattle is by far the best, being well protected against the wind, having thirty fathoms of water, a most excellent holding-ground, being easily approached from the Straits of Fuca, and having a good back country. It is, therefore, in my opinion, the proper terminus for any railroad extending to the waters commonly known as Puget sound.

I am, sir, very respectfully, your obedient servant,

GEO. B. McCLELLAN,
Lieutenant Engineers and Bvt. Capt. U. S. Army.

His Excellency I. I. STEVENS,
Chief of the Northern Pacific Railway Survey.

The majority of Snoqualme Indians are now at Seattle, Alki, and Steilacoom. There are now but seven of their houses near the falls, and some four Yakima houses.

I should have stated that the barometer taken with us was entirely unfit for use.

From the point above the Snoqualme falls where we turned back, we obtained a good view of the country towards the pass.

FORT WALLAH-WALLAH,
January 2, 1854.

DEAR SIR: Your express reached me very opportunely. I arrived here Friday evening, December 30, and McIntosh came in the next day. Acting under instructions delivered in St. Mary's valley, I had already made my preparations, and two days later I should probably have been again moving westward. I should, however, as formerly directed, have taken the route pursued by the emigrants, and crossed the Cascade range by the Nahchess Pass.

A brief note about my movements since leaving you in St. Mary's valley. Winding along the hills edging upon the western border of Flathead lake, and tracing first the main stream of Clark's fork, and then its northeastern fork till this stream ran out, we attained the summit of Marias Pass on the 20th of October, without snow, but with the snow flying in the air as we crossed. Camping in the valley, immediately under the mountains, on the eastern side, that night it commenced snowing, and from that time until we made our third passage of the Rocky mountains the weather was generally cold and snowy.

The pass I find to be impracticable as a wagon route, and available for a railroad only with high grades, for about twenty-five miles, and with a tunnel of at least two miles in length, the mountain work being also generally rock cutting. The height of the pass is about 7,500 feet. The long approach to the summit led me to hope for a better result. Descending on the eastern slopes the next day after the passage, we attained the prairies soon after noon, while our time from Flathead lake to the summit was about a week. On the plains the temperature was quite low during the week that we were getting to Fort Benton, moderating as we approached the Missouri, but for the most of the time rating in the morning as low as 3° to 5° above zero Fahrenheit.

Two mules were left on the plains before we could get to the fort. At the fort there was no snow. We arrived there on the 28th day of October, having had a longer trip than was anticipated, with animals a good deal tired, and out of provisions. The Piegan boy, acting as guide to Lander, was left at the fort. I found Mr. Doty almost destitute of serviceable animals, having just despatched the best of his stock to Lieutenant Grover. Some dozen or thirteen animals, including three government animals, had also just been stolen by the Indians, so that from Mr. Doty I was unable to obtain more than five animals which proved of use to me. Of the stolen animals I learned more subsequently, which will be referred to in my report.

The last day of October we crossed the Missouri just below the fort, and the day being well spent, encamped soon after on a small tributary, just hid from the main river by the high banks rising on either side of the river in that vicinity. That night it commenced snowing again, and so continued during a great portion of the time, until we were on the western side of the mountains. The passage of the mountains was made by the trail used by the Flatheads in going to and from the buffalo ground, lies between Cadotte's Pass and the pass traversed by Lieutenant Mullan, and descends into the plains by Hell Gate fork, intersecting Lieutenant Mullan's route some two or three days after passing the summit. This is the trail almost always used by the Flatheads; and knowing no such stream as Jefferson's fork, our guide supposed, and probably will always suppose, that, as directed by you, he carried us through the great Flathead trail at the head of Jefferson's fork, this being the principal trail used in the buffalo hunt.

Did I care to undeceive him, it would have been too late when I became convinced that what I had already supposed was true. I, however, gave no preference to the examination of the pass on the head of Jefferson's fork, especially as my instructions left me free to the action of my judgment, and the cold and snow were urging us forward to as speedy transit of the mountains as was possible. November the 10th we made our third passage of the mountains, crossing in company with a large party of Pend d'Oreilles, and from this time forward our usually lonely march was enlivened constantly with the presence of Indians—Pend d'Oreilles, Flatheads, and a few Nez Perces—moving forward in common with us, and with their multitude of animals always in sight, stretching along the trail for miles. The Indians were loaded down with meat, and among the multitude of horses one could scarcely detect a single animal free from pack or rider. Travelling somewhat faster than the Indians, each day would bring us among a new set, who, crossing the mountains before us, were pretty well down the valley when we were on the summit. The height of the pass is about 6,000 feet above the sea, the dividing ridge being a mere hill, of not over half the height of that of Cadotte's Pass; sloping off gently on the western side, and rising, not abruptly, on the eastern side. It may, perhaps, give a better idea of this ascent to notice our passage up it. The Indians got in movement before us, and, with the passage of their animals and lodge-poles, the road soon became icy and slippery. At the foot of the hill our animals got crowded in with those of the Indians, and, anxious to get our packs by themselves and free, Pearson drove past the Indians on a trot, making his way by as he passed up the hill. Wagons could be carried up without difficulty.

The second crossing of the Missouri was made under such circumstances as to force our guide for awhile to abandon the route which he intended to pursue, and brought us for awhile in among the rocks crowding upon the river. The weather was very cold, the river high and rapid, and filled with floating ice, and he did not dare to make the passage where he intended. There was accordingly about forty miles here until we struck in upon a trail which wound some distance back from the river, which is not practicable for the passage of wagons, and could not be made so at any reasonable expense. I have no doubt that in this interval a wagon road can be found, either passable in its present condition, or which can be made so at a reasonable expense. Arriving at St. Mary's, and having there an interpreter, I was informed that this is the case. With this exception, I consider that a wagon could be carried from Fort Benton to St. Mary's by the route which I pursued, and in its present condition. I do not mean to say that the route should not be worked over, but only that an emigrant could pass over the route without encountering greater obstacles than an emigrant ought to be prepared to meet and overcome, and in a time not greater than three weeks; sometimes, to be sure, doubling his team, and sometimes taking to the river when the trail passes along a too steep side-hill; but these occasions are rare. The descent by Hell Gate fork is much superior to that by Blackfoot fork. The wagon route across the mountains, I believe, will be found easier by Hell Gate fork than by any other passage, for perhaps a hundred miles north or south of it. The railroad route, I think, is better by Cadotte's Pass, or by the one which Mr. Lander reconnoitred by the north fork of Sun river, simply because the approach to the mountains from the eastern prairie is much easier and cheaper for a railroad, avoiding the rocky and turbulent character of the country in which the Missouri is for some distance involved above the falls. The immediate approach and passage of the mountains at the head of Hell Gate fork is good. A tunnel of not over one mile in length, without high grades, would probably effect the passage. The valley of this fork is also better for a railroad than the Blackfoot fork.

On the 17th November I reached the camp of Lieutenant Mullan. The regret which I felt, to some extent, at not being able to examine the pass at the head of Jefferson's fork, is diminished by learning that Lieutenant Mullan examined the country at the head of this fork, and the report of his survey, transmitted by me, is forwarded with this communication.

Lieutenant Mullan I found in camp about fourteen miles above Fort Owen, and on the 19th of November, with a liberal supply of good animals (twenty-five in number) to guard against the anticipated severities of the Bitter Root mountains, I left the agreeable and comfortable quarters of Camp Stevens, and once more turned towards the mountains. In St. Mary's valley there was no snow, and, in fact, we had a mild rain while I was there. Towards the close of the week succeeding we were at the foot of the mountains dividing the waters of St. Mary's river from the waters making into Lewis's fork. Immediately on turning out of the valley of St. Mary's to follow up its southwesterly fork, its bright, open character was lost, and the valley was narrow and chilly, the snow lying on the ground and the grass growing scattered and scanty. The snow continued to increase in depth until, as the valley ran out, it was quite two feet deep. Thence onward over the mountains for some distance, (about thirty miles,) the snow was from two to three feet deep, the horses toiling slowly through it, and getting but little to eat. Our least day's journey was six miles. Descending to the valley of a stream with which I was then unacquainted, and then supposed, from the information which our Nez Perces guide gave me, to be a branch of the Lou-Lou fork of St. Mary's river, the snow again died out. Leaving this stream, the trail again took to the hills, much to my disappointment; and some half dozen miles from this stream, and about nine days after leaving St. Mary's, I was shut up in the snow at least four feet deep, with a steep hill before us, up which it was impossible for the animals to make their way.

By breaking out the path on foot, then following with the spare animals, then the riding-animals with their saddles, and last the pack-animals, I had succeeded thus far in making my way along. It being near night then, I camped on the spot, and, as everything which could afford them food was buried deep beneath the snow, the animals were turned back to seek the pasture they had left in the morning. The next day was spent in reconnoitring ahead and breaking out a path. Ahead nothing could be discovered but snow and hills. That night it snowed heavily, adding some two feet. Attempting to regain the animals, I became convinced that it was impossible to get them any farther ahead, and immediately commenced preparing for the balance of the journey on foot. At this camp I remained a week, making snow-shoes and sleds, and, as the snow eventually gave place to a rain, in tramping roads. At the end of the week the animals were once more brought to the trench, and once more, just at night, were shut up in their narrow path, walled in by the snow. Our efforts were, however, utterly useless; our road would not sustain them, and a few minutes' struggling was sufficient to wear out our best horses. Convinced that any further delay would not only be useless but dangerous, I moved forward next day with snow-shoes, and packs on our backs.

We had twenty-five good animals in the mountains, which, if left there, would almost to a certainty be every one dead before the close of winter; and with a considerable addition of valuable property in the shape of saddles, blankets, arms, &c., and the peculiarity of my position induced me to make a proposition to my men which, under other circumstances, I should not feel justified in doing; but with these considerations will, I trust, meet with your approval. Pearson and French were sent back with the animals and all that was valuable of the public property, and to them I guarantied (subject to your approval) the extra compensation of twenty dollars per animal, should they succeed in getting them safely to St. Mary's. In reaching our camp of that date, we had passed through over thirty miles of deep snow; and, although the trail which we made at that time undoubtedly would facilitate their return, since then we had had a deep snow, and the return could not be made without some uncertainty and risk—considering, too, that if they do not reach the Territory seasonably their detention would, as they felt, cause them pecuniary loss—I looked upon their attempt to restore public property to a place of safety as an act of extraordinary services, and justifying an extra compensation as an inducement.

It was their intention to descend from St. Mary's by water, but I think that a further consideration will have induced them to give up this method of return, and with horses to take the trail pursued by Lieut. Donelson. It is now thirty days since we separated, and as, after leaving St. Mary's, they will travel rapidly, I expect their arrival here soon after my departure.

Unused to packing and snow-shoes, we were fifteen days before breaking through the woods and mountains. Of clothing we took little other than what we wore; I took only two pairs of socks and two pairs of moccasins. Wilson, Bracken, Agnew, and the guide, made my party. Each of us had two blankets and a tin cup.

Our provisions were, excepting for a few days at starting, flour and salt. At starting our packs weighed from fifty to seventy pounds, and, climbing along the steep hill-sides, over the crust, we found it at first very laborious, making at the outset three, then six, and ten or twelve miles a day in the course of the week, the trail being very hilly and tiresome. Striking the more level country of the Nez Perces, we found the labor of travelling very much diminished.

Arriving among the Nez Perces, we here emerged from the snow. With the Indians I spent several days, finding in their hospitable lodge an agreeable contrast with the discomforts of a camp in the snow, with our somewhat tame fare. At Mr. William Craig's I spent Christmas. From him and the Indians I hired horses to come on here; he received us very cordially, and promptly supplied our wants.

As already stated, I reached this post December 30th, having been forty-two days on the road from St. Mary's.

Notwithstanding the amount of snow on the mountains, the weather was not severe, and milder than we experienced on the eastern side of the mountains between October 20th and November 10th.

Here there is no snow, and at no place between here and the mountains (165 miles) was there over eight inches, and that for a short time only.

To-morrow I hope to get away from here, and am waiting only for the gathering in of the animals. I shall take ten fresh animals with me (obtained from Mr. Pambrun and the Hudson's Bay Company,) to be used only after arriving at the mountains. From here to the mountains I shall use the animals of the expedition, and return them to this post.

Mr. Pambrun has promptly aided me in fitting out. Of course, being bare of everything—saddles, bridles, mess-kit, and the variety of little conveniences which one gathers around him in regular camp—our fitting out is one of unusual trouble. We have learned, however, to dispense with some things once thought necessary. In place of a beef, Pu-pu-mux-mux supplies us with a horse, which I shall take with me, as easier to be driven, and kill when necessary. He will probably go with me for a short distance, but is unable to attend me throughout the trip.

I hope to be able to cross the mountains with horses according to your expectations. Should I not succeed, it is my intention to come through on snow-shoes. I greatly regret that I shall be able to make but a very barren survey. Our fine barometer, brought in safety by Wilson, had three times crossed the Rocky mountains, and in the Bitter Root mountains was cached in perfect order. It was impossible to send it back to St. Mary's. The thermometer Wilson attempted to take along, but lost it within a day or two after starting. My prismatic compass was sent back to St. Mary's. I have with me only a pocket-compass. All geological specimens which had been collected were left in the mountains, none of them having any special importance, and being only interesting as showing the general geological features of the country passed over. Having a somewhat limited wardrobe, although sufficiently warmly clad, we shall arrive at the sound somewhat "rusty." I cannot do otherwise than gratefully mention the members of my party, particularly Wilson, Agnew, and Bracken, as being very deserving of your commendation.

They have discharged their duties well and cheerfully, and cheerfully respond to my decision to pass this the Cascade range, although prior to our arrival here we anticipated other instructions; and supposing that you would send parties from the main train over this route, I had assured them that it was altogether improbable that we should have any further mountain work. Learning from Mr. Pambrun that no parties went through from here, I decided at once to take the mountain route, and indeed, under existing circumstances, give it the preference.

As I said before, your express arrived very seasonably. I have confidence in the realization of your expectations, that the pass will admit of the passage of animals in the winter, and have a wish to see the winter character of the country bordering on the railroad line. Your instructions enjoin upon me to fit out more thoroughly than I had done; and, indeed, I just doubled the amount of rations which I had made ready, besides adding one or two comforts, such as coffee and sugar.

Should I leave my animals, which is of course possible, as even on the plains they are sometimes lost, I shall not feel that they were brought into the mountains on my own responsibility, and should not at any rate have felt justified in purchasing fresh animals. More than this, I am able to act intelligibly as to the character of the passes.

This being celebrated here as New Year's day (in place of the Sabbath,) my letter has been written with fiddling and dancing; and dancing, too, where not only the "fantastic toe" played its part, but where the heel drummed out a vigorous accompaniment. This may apologize for its somewhat dispirited character.

Arriving at the Sound so much later than the parties which have preceded me, you will not consider it unreasonable for me to request that my early return to the States be facilitated as much as possible, and that it may occur as soon as the accomplishment of my duties will admit.

Having quite a large mail (fifty communications,) I was obliged to strip all envelopes and waste-paper in order to save weight. You may accordingly find their order of arrangement somewhat disturbed. Everything, however, has been kept from injury, and your several communications are transmitted in perfect condition.

My letter I leave open until to-morrow.

January 3.—I have nothing of consequence to add. The animals have not yet come in; but I am constantly expecting them, and expect to swim the river and make camp a short distance from here. Two of the tribe of Wallah-Wallahs go with me as far as the Mission, and there I expect to obtain a fresh guide. The day is fine and the weather mild.

Very truly, your obedient servant,

A. W. TINKHAM.

Governor I. I. Stevens,
Olympia, Washington Territory.

Olympia, Washington Territory,
February 1, 1854.

Sir: I have the honor to submit herewith a brief report of my recent exploration from Fort Wallah-Wallah, Columbia river, to Puget sound, by way of the Snoqualme Pass of the Cascade mountains, regretting that, for causes explained in a former letter to you, I had means only for conducting so meagre a survey.

Your instructions of December 12, despatched by special messenger from this place, reached me at Wallah-Wallah on the 30th of the same month, and the day after my arrival there. The Cascade range, barring up the direct approach to the sound from the open and favorable valleys of the Columbia and its northern tributaries, had, from the earliest consideration of the survey, been to me one of its great features of interest; and, impelled by the desire to know by actual observation its obstacles or facilities, as affecting the construction of a railroad, I had, previous to the arrival of your despatch, made arrangements to pass through this range of mountains in closing up my route to the Pacific. Your despatch put me in possession of such information as enabled me to proceed intelligently, and at the same time furnished me with such resources as to secure me from any unnecessary risk and exposure to be apprehended from crossing this important range of mountains in mid-winter.

The several members of my little party had cheerfully responded to my wish to attempt the proposed exploration, although they had just escaped from a long and somewhat tiresome detention in the mountain snows of the Bitter Root range, and it was from no reluctance on their part that I saw fit to release them from any further winter work in the mountains, and to go forward alone.

On the 7th of January, with two Wallah-Wallah Indians, I proceeded up the Columbia till it receives the waters of the Yakima river, and then taking this latter stream, turned westwardly to trace its waters to their source, in the close vicinity of which also spring the headwaters of the Snoqualme and White rivers, emptying into Puget sound. The valley of the Yakima, adjacent to the Columbia, is wide, open, and devoid of timber, except in the bottom-lands of the river, and even there the trees in any considerable quantity are not found until one passes up the river some forty miles from its mouth, about seventeen miles above Wallah-Wallah. Scattered along the banks of the river, in their winter lodges, are small encampments of the Wallah-Wallah and Yakima Indians, subsisting on their summer gatherings of dried salmon, potatoes, dried roots, berries, and occasionally grain; and many of them are wealthy in their herds of horses and cattle. These Indians I ever found hospitable and kind, and in a more full report I shall have occasion to notice more particularly their acts of attention. On the 11th of January I reached the Yakima Catholic mission, under the care of the Rev. Father Poudery, located in the midst of a division of the Yakima tribe, and just above the Atahnam tributary of the river. Farther than this my Wallah-Wallah guides were unwilling to proceed, and leaving them here, I obtained, with some little delay, the services of two Yakima Indians. The Indians, secure in their lodges, were unwilling to exchange their shelter for a cold and laborious passage of the mountains, and I am particularly indebted to Father Poudery for his aid in securing the two who accompanied me, and who throughout have proved faithful and serviceable.

Passing over the intermediate portion of the route, on the 17th of January I arrived within three or four miles of the Kle-al-um lake, the source of one of the principal forks of the Yakima river. To this point I had travelled without difficulty with horses, and here was to commence the most laborious part of the exploration. The snow was now about two feet deep, and the weather for several days had been intensely cold—not more cold than is experienced in all our northern Atlantic States at this season; but severe for continuous exposure, day and night, without other than the slight protection I found it convenient to bring with me. Packing on snow-shoes had previously taught me to dispense with everything not absolutely essential to one's sustenance and health; and to make my camp equipage as light as possible I had thrown aside my tent.

No grass could be obtained near here, and the few Indians residing in the vicinity of the lake were without animals; but thirty miles lower down on the river the snow was very light—not over three to four inches deep; the grass was good and exposed, and the Indian horses were in good condition. Extending still farther down, and reaching the Wallah-Wallah, the horses in thousands are ranging throughout the borders of the valley, with abundant grass, and rarely with any trouble from the snow.

The railroad facilities had continued good from the entrance into the valley of the Yakima, the valley being generally several miles wide, with hills rising gradually on either side of the river, and rarely closing in upon its banks. The valley was now narrow; the firs and pines had intermixed and mingled with the cotton-wood of the bottoms of the stream, and were soon to become the exclusive growth. Here, too, commences the wooded region extending to the shores of the Pacific, and where exhaustless stores of firs and cedars will not only furnish the building material for a railroad, but will, from its resources, with suitable means of transportation, supply the wants of the country east of it, lacking in timber and fuel.

Sending back my horses in the care of an Indian, to be returned to Wallah-Wallah, the balance of the exploration was conducted on foot, and with snow-shoes when necessary. To aid in packing, and also from the necessity of procuring an additional guide, I here increased my Indians to five in number. From them I obtained dried salmon, which they have in abundance, and a variety of dried roots. Their potatoes are not generally disturbed in the colder portions of winter.

Yakima river finds its source mainly in three lakes, from four to ten miles long, and lying in a line nearly east and west—Kle-al-um, Ka-ches, and Kitch-e-lus lakes, the two more distant being some twenty-five to thirty miles apart. Each of these lakes furnishes its tributary to the main stream, up the valley of which the railroad encounters little of serious obstacle until on the borders of Kitch-e-lus lake, the most westerly of the three. On the edge of this lake I encamped on the 20th of January. To within twelve miles of this camp I had not found the snow to have an average depth greater than two and a half feet—a dry, cold snow; but beyond this the snow had greatly increased in depth, varying from four to six feet, and at the night camp some four feet deep. The lakes were frozen and covered with snow, and their smooth, even surfaces afforded easy travelling for snow-shoes. Some five miles distant from this camp, in the summit of the pass, is what in the depth of the snow I took to be a small, open marsh, but have since learned is a small pond, whose waters are turned on either slope of the divide. Although, with the disadvantages under which I was placed, I could not examine the pass with the care I desired, and with which I felt confident it had been examined by the other parties to whom you had committed the special exploration of the passage of the Cascade range, I was still satisfied that it afforded fair facilities both in its ascent and descent for a wagon and railroad—either with the use of eighty-feet grades for a limited number of miles and a short tunnel, or with a longer tunnel and easy grades.

Wishing to know the real difficulty to be apprehended from the passage of these mountains in the winter season by railroad trains, I gave particular attention to the measurement and examination of the snows on the route. From Kitch-e-lus lake to the summit, some five miles, and where occurs the deepest snow, the average measurement was about six feet, but frequently running as high as seven feet. In a storm occurring on the night of the 20th, about one and a half foot of this depth was deposited—a very light, dry snow; so light as to afford no support to our snow-shoes, and making our progress slow and laborious. The whole of the snow was very light and dry, deposited in successive layers of from one to two feet, and for the greater part of the route had lain undisturbed since their fall—every twig and bush bowing under their bulky burden. These snows present little obstruction to removal in comparison with the compact, drifted snows of the Atlantic States, and would cause very little detention to the passage of trains. Passing on to the western slope of the Cascades, the snow rapidly disappears; fourteen miles from the summit there was but eight inches of snow, and thence it gradually fades away as the approach is made to the shores of the sound.

It should be borne in mind that this examination was made in mid-winter, from the 20th to the 25th of January, and in a winter known to be one of unusual cold, and that the accumulated snows of the winter were but about six feet in their greatest depth, and this depth only covers some half dozen miles of the route, and embracing, too, that portion of the route which will be tunnelled and protected. Descending, the snow rapidly decreases on both slopes of the mountain, on the eastern side about thirty-five miles from the summit, amounting to but from one and a half to two feet in depth, and on the western side fading away until in the short distance of fourteen miles it is only eight inches deep.

Without giving the details of the remainder of my journey to the sea-board, which in a more extended report may be noticed, I reached the vicinity of Seattle, under the guidance of Indians, on the night of January 27, tracing a very excellent railroad connexion from the valley of the Snoqualme to that commodious and beautiful harbor.

I am, sir, very respectfully, your obedient servant,

A. W. TINKHAM.

His Excellency Gov. Isaac I. Stevens,
Chief of the Northern Pacific Railroad Survey.

Office Northern Pacific Railroad Exploration and Survey,
Olympia, Washington Territory, February 13, 1854.

Sir: I have received your instructions of December 1, 1853, disapproving of my arrangements for a winter examination of the mountain passes, and for a resumption of the work should Congress make an appropriation, and directing me to bring my operations to a close in accordance with the original instructions.

These instructions will be promptly carried out, and the parties in the field, of Lieutenant Grover, Lieutenant Mullan, and Mr. Doty, making winter examinations, will be called in as early as practicable. The best arrangements will be made in the spring for the disposition of the animals and property. But I earnestly submit to the department the importance of the continuation of these surveys, and indulge the hope that Congress will make liberal appropriations, both in a deficiency bill and in the general appropriation bill, in order that the field now so well entered upon may be fully occupied. In addition to the suggestions which I made at Fort Benton, I will respectfully state that the route from the Platte by the South Pass and the Great Salt Lake settlement to the Columbia river; that the question as to whether a route can be found from the system of roads now pushing westward through Missouri and Iowa, through the Black hills, into the region between the Missouri and the Yellowstone, and thence over the low passes examined by me to the valley of Clark's fork, and also that the practicability of a route into this same general region, and over the same pass, from the grand plateau of the Bois des Sioux, the route proceeding nearly westward, crossing the Missouri and the Black hills, ought, in my judgment, to be thoroughly considered in this general exploration of the region between the Mississippi and the Pacific.

The preliminary report will be sent, if by the greatest exertion it can be got in readiness, by the steamer which will leave San Francisco on the 1st of March, and at the same time the accounts of the expenditures in the survey.

I will respectfully call the attention of the department to the peculiar circumstances of my exploration, and which will, it seems to me, explain the exceeding of the appropriation, with every desire and effort on my part so to arrange the scale and conduct it as not to involve a deficiency. The field was almost totally new, rendering it impossible to form an estimate. Much work of reconnaissance had to be done which had previously been done for all the other routes, before a direction could be given to the railroad examinations and estimates proper. Unforeseen expenses, in the way of presents, &c., had to be incurred to conciliate the Indian tribes; for our route was through the only one, so far as I was informed, that at the time was deemed particularly dangerous, and the investigation of the question of snow was a vital and fundamental one, essential to making any reliable report at all, and included within the express requirements of the original instructions. I deeply regretted the deficiency which I found impending at Fort Benton, and I took at that place that course which I believed Congress and the department would have taken under the circumstances.

I am, sir, very respectfully, your most obedient,

ISAAC I. STEVENS,

Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS, *Secretary of War.*

WAR DEPARTMENT, *Washington, April* 12, 1854.

SIR: I have received your letter of the 13th of February. The department does not doubt that in the course you pursued in taking measures for prosecuting the survey, you were actuated by zeal for the success of the object in your charge. Congress having appropriated a specific sum for surveys, the department had no authority to authorize any expenditure beyond it, or the contract of any debts to be paid from future appropriations. An estimate has, however, been sent in for an appropriation to pay the arrearage necessarily incurred.

Very respectfully, your obedient servant,

JEFF'N DAVIS,

Secretary of War.

Gov. I. I. STEVENS,

Olympia, Washington Territory.

OFFICE NORTHERN PACIFIC RAILROAD EXPLORATION AND SURVEY,
Olympia, Washington Territory, March 6, 1854.

SIR: I have the honor to inform you that, on the 4th instant, Garry, the chief of the Spokanes, reached this place with an express from the St. Mary's valley, bringing letters from Lieutenant Mullan, and information that the route from that place was entirely practicable for horses; no snow of greater depth than one and a half foot having been found, and that depth only in crossing by the trail the divide between the Jocko and the Bitter Root river and some of the mountain spurs that overhang Clark's fork. The express left the camp of Lieutenant Mullan on the 17th of January.

Lieutenant Mullan, on the 28th of November, left his camp to make the connexion with Fort Hall, and, crossing the Rocky mountains twice, both going and returning, but in different routes, he reached his cantonment on the 12th of January. A copy of his report I herewith enclose. I will particularly call your attention to his statement that the grass was luxuriant in the mountain valleys; that the greatest depth of snow on the Rocky Mountain divide was fifteen inches; and that Victor, the Flathead chief, was, at the date of his letter, (the 12th of January,) crossing the mountains on his return from the plains beyond.

I hope to be able to send off my preliminary report by this steamer. The drawing and report are all but finished. A railroad line is laid down from actual observation, (the line of Lewis and Clark's Pass and of the Columbia and Cowlitz rivers.) No grade exceeds fifty feet, and only for a few miles is the grade more than forty feet. There is but one tunnel, and that in crossing the Rocky Mountain chain; and the summit-level of the road is about five thousand feet above the sea. Every exertion has been made to prepare it at an earlier date; but the late arrival of Mr. Tinkham, and the great amount of materials to be examined and put together, will explain to the department the delay which has occurred.

I expect the arrival of Lieutenant Grover in some two weeks, and I indulge the hope that his examinations will be decisive as to the snow question.

Very respectfully, sir, your most obedient,

ISAAC I. STEVENS,

Governor of Washington Territory, in Charge of Exploration.

Hon. JEFFERSON DAVIS,
Secretary of War, Washington, D. C.

CANTONMENT STEVENS, BITTER ROOT VALLEY, W. T.,
January 12, 1854.

SIR: I have the honor to report, that in conformity to the paragraph of your letter of instructions, dated at the St. Mary's village, of October 3d, 1853, "to continue the exploration of the country between the Rocky and Bitter Root ranges of mountains, extending to Fort Hall, to connect the survey of Colonel Fremont, and northward to the Flathead lake, and even to the upper waters of Clark's fork of the Columbia," I left my main camp, on the Bitter Root river, on the 28th November, 1853, with the intention of making the connexion with Fort Hall, taking with me Mr. Adams as artist, the Flathead interpreter, Gabriel, as guide, and three men. I merely submit at present for your consideration the general character of the route followed, accompanied by a rough sketch, intending to send by next express, or by Lieutenant Grover, a detailed report and a map of the country passed over. In going to Fort Hall, I followed up the main stream of the Bitter Root river to its headwaters, by a very easy, practicable, and beautiful route, to the dividing ridge of the Missouri and Columbia waters. Here I found the ascent steep, and the divide very high, the descent being very easy and gradual. Empty wagons can, I think, however, cross this divide in going to the south, but freighted ones not. In going towards the north there is no difficulty whatever, as wagons this season have crossed it. Crossing the dividing ridge, I fell upon three of the head branches of the Wisdom river, the principal tributary to the Jefferson fork of the Missouri; hence to the main stream, crossing the northwestern branch, being the one followed by Messrs. Lewis and Clark in their expedition to the Pacific in 1804 and '5, and following up the southeastern branch to near its head by a very beautiful, easy road to the dividing ridge of the Snake river waters, crossing by a very good road for pack animals, but not for wagons. Here we fell upon the Medicine Lodge creek, which I followed down for twenty miles; leaving it to my right, at the distance of twelve miles it forms a lake called "Medicine Lodge lake;" crossing the sage plain of Snake River valley for a distance of fifteen miles, we fell upon a small mountain stream called the Camash Prairie creek, which also forms a lake in the great sage plain of Snake River valley; thence across the sage plain to Snake river, or Lewis's fork of the Columbia, which I followed down for two days, crossing it by a ford with two and a half feet of water, about twenty-one miles east of Fort Hall, where I arrived on the 15th of December, 1853. From the St. Mary's village to the waters of the Missouri, we found the grass rich and luxuriant, and wood in abundance. Scarcity of timber and barrenness of soil characterized the remainder of the route to Fort Hall, except a few localities along the Snake river, where we found an abundance of wood, and very good grass. Remaining at Cantonment Loring five days to recruit my animals, I left on the morning of the 19th, intending to return by a new and different route; keeping along the eastern base of the Bitter Root mountains, or main chain of the Rocky mountains. You will see that from the route followed to Fort Hall, we crossed the dividing ridge of the Missouri and Columbia waters twice. This was necessary from the peculiar configuration of the mountain ranges, which are so formed as not to allow of a practicable route by keeping west of the main chain of the Rocky mountains the whole distance. The whole chain of mountains from Bitter Root valley to Fort Hall is formed of smaller ridges or chains, arranged in beds, as it were, with beautiful prairie valleys intervening, through which flow mountain streams, covered with timber, and covered with an abundance of rich grass, thus giving excellent recruiting stations, or rendezvous for the Indians, with their large bands of horses. From the Snake River mountains to Lewis's fork of the Columbia the country, as far as I travelled, is characterized by the exceedingly great abundance of the artemisia or wild sage found growing; scarcity of grass; extreme barrenness of the soil, which is covered in most places with large beds of black, honey-combed, volcanic rock, which latter is the great geological feature that characterizes the country for hundreds of miles along the Snake River valley. From the St. Mary's village to the waters of the Jefferson fork of the Missouri the geological formation is principally granite and gneiss. On the waters of Jefferson river and its tributaries the geological features are completely changed, the formation becoming limestone and conglomerate principally.

In returning from Fort Hall I continued on the same route till arriving at the main stream of the Jefferson river. Here our course lay more to the east. Crossing the Jefferson river we fell upon the main stream of Wisdom river, a few miles above its mouth, passing between the "Rattlesnake Bluffs" and "Beaver's Head," two prominent and well-known landmarks of the valley of Jefferson river. These names were given them by Messrs. Lewis and Clark. This stream I followed to one of its head branches—to the dividing ridge of the Hell Gate river waters, which we found to be a low divide, of easy ascent and descent. My course lay down the valley of the main branch of the Hell Gate river to its junction with the "Little Blackfoot Fork," which latter stream was followed down from its head, both by Mr. Tinkham and myself, in our respective reconnaissance from Fort Benton; and I would here remark that this stream of the "Little Blackfoot Fork" has been miscalled both by myself and Mr. Tinkham: we took it to be, and have given to it the name of, the Hell Gate river, and I avail myself of this opportunity to correct the error. The stream followed down by the main train from Fort Benton was the "Big Blackfoot Fork," and not the "Blackfoot Fork." My return route from Fort Hall lay over a much better though longer road than the one followed in going south, and is by far the better wagon road; in a word, there is no difficulty whatever in the passage of wagon trains by this latter route. I estimated the distance travelled by the route to Fort Hall to be 325 miles, the return route 386 miles, to my main camp—making a difference of sixty-one miles in favor of the more western route, but over a more rough and more uninviting country. We did not experience snow to a greater depth than fifteen inches on a level, and this only in places. On the dividing ridges, however, the cold at times was very intense, the thermometer for many days being as low as 20° and 25° below zero. This was one great difficulty to contend with, which made travelling exceedingly uncomfortable, and hard both for men and animals. Myself and two of my men were frosted by the cold. We arrived at our main camp on the 10th of January, 1854, after an absence of forty-four days. It had been my intention, when leaving the Bitter Root valley, to connect Fort Hall with Fort Benton direct; but finding my animals very much jaded by their long march, and the season so far advanced, with such intense cold, with great reluctance I was compelled to abandon it. I would have desired to have made a barometical profile of the route travelled; but fearing that our regular barometrical register, in the Bitter Root valley, would be thus interfered with, I was unable to take it. The temperature, however, was noted on each day till within a few days of the Bitter Root valley; by comparing which with those taken in the Bitter Root valley, I found the cold much more intense on the eastern than on the western side of the mountains. I am under the impression that the route could not be travelled at any season later than I travelled it. But having partially made the connexion as far as the Jefferson fork of the Missouri, when I set out to go as far as Fort Hall, and being deceived in my guide, I was anxious to complete the line, and thus connect our survey with that of Fremont. It is impossible to give in this short sketch the character of each portion of the route travelled, being over 700 miles, but by Lieutenant Grover's or the next express I will send a detailed report and the accompanying map.

Sketches of the principal features of the route were made with great accuracy by Mr. Adams, which will be sent down in the spring, together with those taken in the meanwhile.

Truly, your obedient servant, J. MULLAN,

Lieutenant United States Army.

Governor I. I. Stevens,
In Command of the Northern Pacific Railroad Survey, &c.

Washington, D. C., *November* 27, 1854.

Sir: I most respectfully beg leave to protest against the following portion of Governor Stevens's published correspondence, as being erroneous, and consequently unjust to me:

"At Fort Union the observations were placed in charge of Lieutenant Donelson, with instructions, if practicable, to get longitudes by lunar distances; but Lieutenant Donelson was not able to report any results except for latitude."

In proof that this is erroneous, I respectfully refer you to the orders and letters which accompany Governor Stevens's first published report; and I would say, that no verbal understanding or instruction to the above effect ever prevailed.

I much regret being compelled to object to a statement of one under whom I have served for so long a time, and under such peculiar circumstances.

Feeling it to be due to myself, I most respectfully ask your indulgence for the course I take.

I have the honor to be, sir, with great respect, your most obedient servant,

A. J. DONELSON,

Second Lieutenant Engineers.

Hon. Jefferson Davis,
Secretary of War, Washington, D. C.

[☞ See note on next page.]

NOTE.

The Narrative of the Exploration, accompanied by Views illustrating the Features of the Country, the Natural History, Botanical and other Scientific Reports, with Illustrations, will be found in a Subsequent Volume.

ALPHABETICAL INDEX

TO

GOVERNOR STEVENS'S REPORT.

PREPARED BY LIEUT. E. B. HUNT, U. S. A.

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